REQUEST FOR PROJECT/PROGRAMME FUNDING FROM THE ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project must be fully prepared (i.e., fully appraised for feasibility) when the request is submitted. The final project/ document resulting from the appraisal process should be attached to this request for funding.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
1818 H Street NW
MSN N7-700
Washington, D.C., 20433
USA
Fax: +1 (202) 522-3240/5
Email: afbsec@adaptation-fund.org

ADAPTATION FUND

PROJECT PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT INFORMATION

Project Category: National.

Country: Peru

Title of Project: Implementing protection technologies to foster the resilience of aquaculture in the regions of Huanuco, Junin, and Puno to strengthen food security in the context of extreme events associated with climate change.

Type of Implementing Entity: Regional Implementing Entity (RIE).

Implementing Entity: CAF, Development Bank of Latin America.

Executing Entity: Ministry of Production of Peru (PRODUCE).

Amount of Financing Requested: US$ 5,298,180 (4 years).

Project Background and Context:

A. Climate change context

1.1. Peru is the third largest country in South America. Within its territory lay the Andes Mountain range, a geological landmark that divides the country into three geographical regions: the coast, the highlands, and the rainforest. The presence of the Andes Mountain range along with the Peruvian coastal current determines and affect the country's ecological and climatic conditions. Because of these concurrent elements, Peru encompasses almost all existing global climatic variants, and significant rainfall variability depending on the region and the time of the year (SENAMHI, 2007; Avalos, 2005). This diversity includes the arid coastal weather, the cold semi-dry weather in the highlands, the temperate climate of the inter-Andean valleys, the warm climate with heavy rainfall in the rainforest and the country's northern area, and the cold and dry climate typical of the Andean highlands (SENAMHI, 2008).

1.2. Climate change has intensified the vulnerability of Peru's aquaculture sector. Ocean warming, the water column's surface layer stratification, sea level rise, acidification, deoxygenation, extreme precipitation and flooding are some of the projected climate threats likely to impact the aquaculture sector.

1.3. The increase in the frequency and intensity of extreme weather events associated with climate change has impacted both natural and human systems. In the last 37 years, Peru has recorded 10 episodes of moderate to severe droughts[1]. Meanwhile, heavy rains are one of the most important causes of disasters and emergencies; in 2017 alone, there were 3,543 emergencies (INEI, 2018). In 2014, 64% of the recorded emergencies were related to extreme weather events, which left around 20,000 victims and 190,000 individuals affected[2]. In terms of material damage, 1,600 houses were destroyed, and 21,000 houses were

[1] SENAMHI. (2019). Caracterización espacio temporal de la sequía en los departamentos altoandinos del Perú: (1981-2018). Retrieved from: https://www.senamhi.gob.pe/load/file/01401SENA-78.pdf

[2] Disaster victims: A person or family whose health or property has been partially or completely affected by an emergency or disaster, and who temporarily lack the socioeconomic capacity to recover.

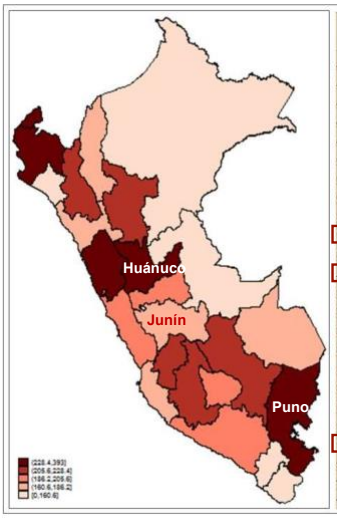
affected. These losses are significant for Peru's economy. On the other hand, the El Niño phenomenon has left thousands of victims, mainly in the northern and coastal areas. Climate change is expected to exacerbate the intensity of El Niño, producing even more devastating consequences. The intensity of this phenomenon can cause Pacific waters to warm up to 3º or 4ºC above normal ocean temperatures[3].

1.4. Peru's Third National Communication notes that the main climatic threats include an increase of average temperature, loss of glacier area, increase in sea level and coastal erosion, incidence of prolonged droughts, increased frequency of intense rains, floods, landslides, alluvium, acidification and contamination of oceans, rivers, and lakes[4]. In terms of future projections, Peru will face the following situations between 2036 and 2065: i) 10%-20% average increase of precipitation; ii) 2°C-3°C and 4°C-6°C average increase of maximum and minimum air temperature, respectively; and iii) More than 300% increase of potential runoff from coastal rivers and -52% decrease of runoff from mountain and rainforest rivers vis-à-vis 1970-1999 and 1980- 2009. Therefore, it is expected that climate change impacts will increase.

1.5. According to data from the Humboldt Current System, two significant temperature increases were caused by the 1982-83 and 1997-98 El Niño Phenomenon. Extreme climatic events such as prolonged droughts, heavy rains, deoxygenation episodes, red tides, and floods are common in Peru and have caused serious damage to infrastructure and interrupted communications and food supply chains, which has harmed all economic activities, including aquaculture.

1.6. Floods, mudslides, and alluviums can affect hydrobiological and water resources due to the increase in sediment load, which affects both the quality of water resources and the aquaculture and fishing infrastructure, among other things. It should be noted that the magnitude of the impact of floods and landslides increases considerably when they are associated with the occurrence of El Niño events and cause damage to fishing or aquaculture, either due to tidal waves or by dragging contaminated sediments (PRODUCE, 2015).

1.7. According to the study *Diagnóstico de vulnerabilidad actual del sector pesquero y acuícola frente al cambio climatico*[5] (Diagnosis of current vulnerability of fisheries and the aquaculture sector to climate change, PRODUCE, 2020), Piura, Puno and Tumbes are the regions where the aquaculture sector is most vulnerable to climate change and El Niño.



Regiones	SE	Ambiental	Climático	Estrategia Regional	PUNTAJE FINAL
Amazonas	1	4	3	1	2
Ancash	2	4	2	5	3
Apurímac	1	4	4	2	2
Arequipa	1	4	3	2	2
Ayacucho	1	3	4	4	2
Cajamarca	1	4	4	4	2
Callao	-	-	-	5	-
Cusco	1	4	4	4	2
Huancavelica	1	3	3	5	2
Huánuco	1	3	4	5	2
Ica	1	4	2	1	2
Junín	1	3	3	4	2
La Libertad	1	4	2	1	2
Lambayeque	1	2	1	1	1
Lima	1	3	3	2	2
Loreto	1	2	2	2	2
Madre de Dios	1	4	2	5	2
Moquegua	1	4	1	5	2
Pasco	1	3	2	5	2
Piura	4	4	3	1	4
Puno	2	4	3	2	3
San Martín	1	4	3	5	2
Tacna	1	3	1	1	1
Tumbes	2	4	2	5	3

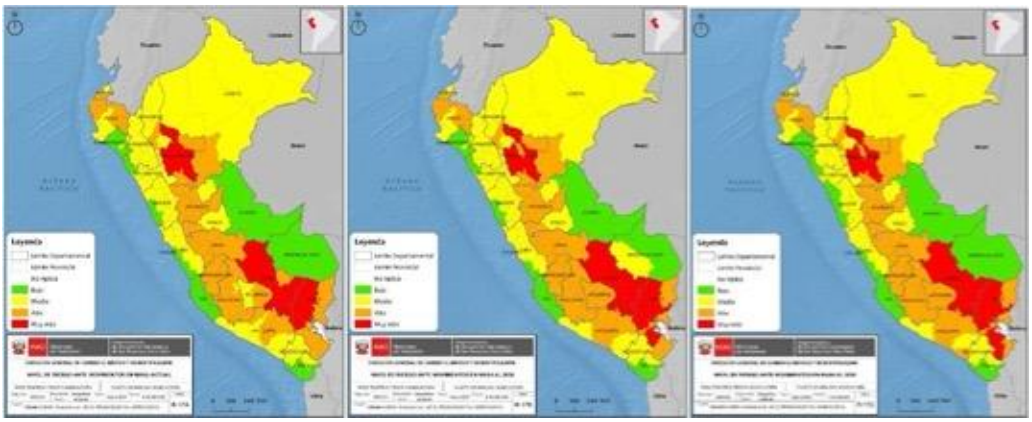
Fuente: Elaboración Libélula

Figure 1. Map of vulnerable areas for aquaculture 2020

1.8. Generally, the threat represented by mass movement to the aquaculture sector is in especially significant in a number of northern and southern regions of the country. Specifically, the departments of San Martín, Cusco and Puno are confronted with more severe mass movements risks, since they are more exposed and vulnerable to high/very high level of mass movement hazards. The current and future scenarios for 2030 and 2050 show very similar risk levels of mass movements, except for some Junin provinces, where there is a slight increase in risk levels in 2030. The following provinces will face a very high risk by 2050: Acomayo, Anta, Azangaro, Bellavista, Calca, Canas, Canchis, Carabaya, Chumbivilcas, Cusco, El Collao, El Dorado, Espinar, La Convención, Lampa, Mariscal Caceres, Melgar, Moyobamba, Paruro, Paucartambo, Picota, Puno, Quispicanchi, Rioja, and Urubamba[6].

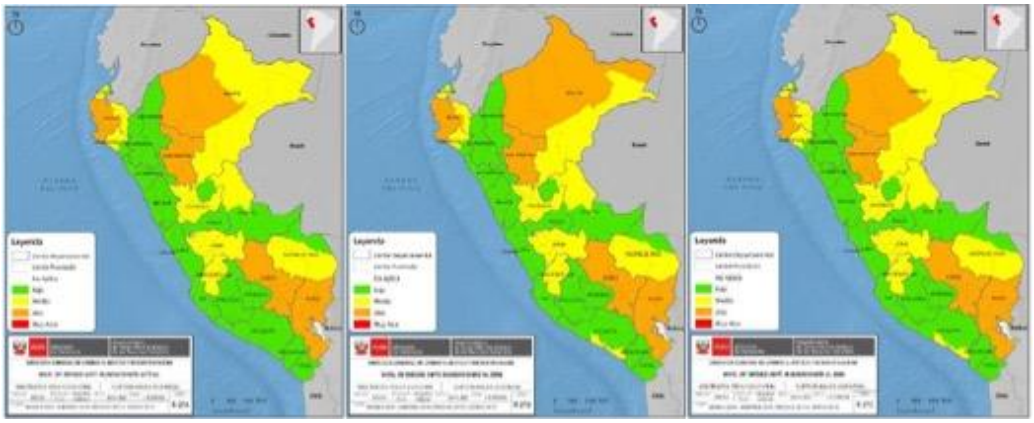
[3] Wang, B., et al (2019) Historical change of El Niño properties shed light on future changes of extreme El Niño. https://www.pnas.org/content/pnas/116/45/22512.full.pdf
[4] MINAM. (2016). Tercera Comunicación Nacional del Perú a la Convención Marco de las Naciones Unidas sobre el Cambio Climático
[5] PRODUCE. (2020). Diagnóstico de vulnerabilidad actual del sector pesquero y acuícola frente al cambio climático. Retrieved from https://www.produce.gob.pe/documentos/pesca/dgsp/publicaciones/diagostico-pesquero/Tomo-2.pdf
[6] MINAM (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático Retrieved from: https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf.

Figure 2. Risk levels for mass movements: currently, in 2030 and 2050[7]



1.9. The flood risk for aquaculture is high in coastal and rainforest areas in the country's northern and southern regions. This is mainly because these areas are highly vulnerable to flooding. In the case of the northeastern rainforest in the department of Loreto, the flood risk is high due to the relief's intrinsic characteristics, low slope, and the Amazon River's fluvial dynamics. Compared to the current period, the flood risk level will increase by 2030, and will decrease by 2050 due to a reduction in rainfall. (*Plan Nacional de Adaptación.* MINAM,2021).

Figure 3. Flood risk levels: currently, in 2030 and 2050[8]

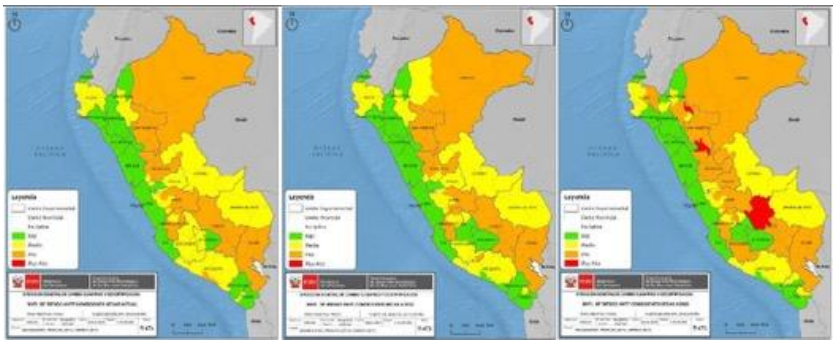


1.10 The aquaculture sector is at high risk from dry conditions in the country's northern and southern regions, mainly in the rainforest and highlands. On the other hand, the risk caused by dry conditions is very high in the departments of San Martín, Cusco and Puno due to the high exposure to dry conditions and the high level of aridity hazard in these departments. A slight increase in the level of risk from dry conditions is expected by 2050 due to a projected decrease in rainfall. La Convención, Rioja and Toache are the provinces with very dry conditions.

[7] MINAM (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático.

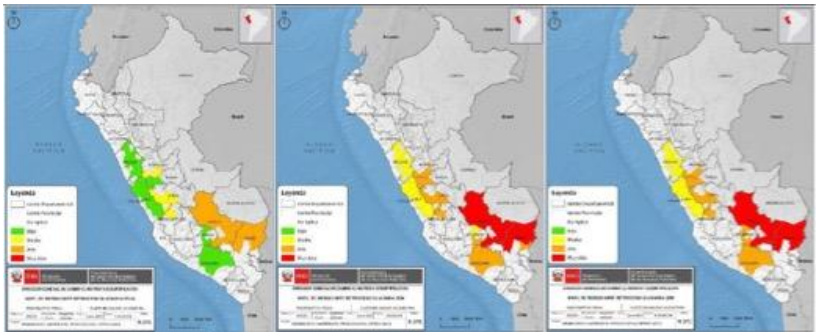
[8] MINAM. (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático Retrieved from https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf?v=1623245610

Figure 4. Level of risk of dry conditions: currently, in 2030 and 2050[9]



1.11. The aquaculture sector is at high/ very high risk from glacial retreat, mainly in southern Peru. Due to glacial retreats, a change in the load of sediments and pollutants transported downstream during precipitation events is expected. This would alter the quality and quantity of water resources that aquaculture depends on.
In the central Andes, glacier melting is a direct consequence of rising temperatures, which cause more rain (rather than snow) on glaciers, increasing solar energy absorption as albedo decreases and leading to accelerated ice melt (Herzog et al. 2011). Glacier water accounts for 5% of the water contributions to Lake Titicaca in the Puno region. Their disappearance would have severe consequences for the water supply provided by the wetlands, especially during the dry season (Hoffmann and Requena, 2012). In fact, wetlands play an essential role as they mitigate water losses due to evaporation during the dry season. They are critical in controlling the flow of the tributaries into the lake. As they are mainly fed by melting glaciers, if water inflow from glaciers disappears, the water cycle and the lake's natural balance may be disturbed. Therefore, glacier regression would cause a short period of intensified tributary flows due to ice melting, followed by a major drought (Hoffmann and Requena, 2012, Rabatel et al., 2013)[10].
Increased and very high levels of risk from glacier retreat are expected in the departments of Cusco and Puno by 2030 and 2050. The following provinces will have very high-risk levels of glacial retreat in 2030: Urubamba, Anta, Canas, Calca, Canchis, Chumbivilcas, Paucartambo, Melgar, Quispicanchi, Carabaya, Sandia and La Convención. The following provinces will have very high-risk levels of glacier retreat in 2050: Anta, Calca, Canas, Canchis, Carabaya, Chumbivilcas, La Convención, Melgar, Paucartambo, Quispicanchi, San Antonio De Putina, Sandia and Urubamba (Plan Nacional de Adaptación. MINAM,2021).

Figure 5. Level of risk of glacial retreat: currently, in 2030 and 2050[11]



1.12. The El Niño phenomenon implies higher temperatures and intensified rainfall, which would increase the mortality of the aquaculture sector's hydrobiological resources due to the thermal effect and surge in sediments. Additionally, changes in oceanographic parameters due to El Niño will affect aquaculture production due to anoxia. Global warming will cause changes that lead to negative impacts on aquaculture

[9] MINAM. (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático Retrieved from: https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf.

[10] Instituto de Investigación para el Desarrollo –IRD Representation in Bolivia (2018). Estudio pluridisciplinario del lago Titicaca (Bolivia – Perú). https://borea.mnhn.fr/sites/default/files/ISTOM%20Informe%20final%20Lago%20Titicaca%202018.pdf

[11] Ministerio del Ambiente. (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático. Retrieved from: https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf .

activities. For example, eutrophication and stratification processes could be exacerbated and, consequently, this would affect food chains and the availability and quality of habitats.

1.13. Extreme events associated with climate change will affect aquaculture productivity, hydrobiological resources use, and the Peruvian population's food security. Floods, mudslides, and alluviums will affect aquaculture crops due to increased sediment, which will alter water quality[12]. This will lead to losses in farmed hydrobiological resources. Additionally, there will be imminent damage to infrastructure and disruption to the distribution of market products.

1.14. The increase in average water temperature impacts the metabolism of hydrobiological resources, the physicochemical properties of water and aquaculture production. Likewise, the retreat of glaciers has led to changes in sediment and pollutant loads transported downstream during floods. Consequently, mountain ecosystems and the water regime's quality, quantity, and seasonality have been altered, which could affect aquaculture. Moreover, sea level rise is another threat caused by the loss of ice mass of caps and glaciers, as well as the ocean's thermal expansion caused by rising temperatures. The Peruvian National Service of Meteorology and Hydrology (SENAMHI) estimates that sea levels will rise by 15 to 21 cm in 2020-2050. This could affect aquaculture activities at sea due to the risk of flooding, the increased presence of salts in groundwater, and the loss of areas for aquaculture activities.

1.15. On the other hand, droughts will cause losses due to water shortages in aquaculture crops, especially those with open systems. Arid conditions will alter the behaviour of farmed species, reducing the productivity of target species[13].

A.1. Climatic context for the regions of Huanuco, Junin and Puno

A.1.1. Huanuco's climatic context

1.16. Rainfall is highest in the eastern zone or the Amazon Rainforest ecoregion of the Huanuco Region and can exceed 2,500 mm per year. The lowest accumulated annual rainfall in the western region (Puna ecoregion) is 500 - 1,000 mm.

1.17. The average annual maximum temperature in Huanuco varies from 8°C to 34°C and the average annual minimum temperature varies between -12 to -10°C and 20 to 22°C, with an inverse relationship between relief and the spatial distribution of this variable; as altitude increases, air temperature decreases. Meteorological records for the last 47 years indicate that extreme temperatures show an increasing annual and seasonal trend (0.16 °C/decade). Increasing temperatures are most likely leading to more accelerated evaporation and evapotranspiration rates in the basins and a lower storage capacity for solid water (snow) in the Puna ecoregion.

1.18. Likewise, during the same period, annual precipitation has increased and has become more irregular during seasons: it increases in winter and significantly decreases in summer. Rainy episodes are more frequent, although they are not intense and do not last long, and alternate with more frequent consecutive dry days. Over the last ten years, there has been an increase in extreme rainfall and drought events.

1.19. There has been an annual increase in extreme events associated with climate change. Between 2003 and 2012, there were 1,301 hydroclimatic events in Huanuco, causing harm to people and damaging social and road infrastructure or the productive sector. The most frequent events are rainfall (27%), strong winds (22%), frost (15%) and floods (14%). Climate change and extreme events in the region have damaged nearby housing, water and sanitation systems, affecting the security and habitability of rural populations. In the last 10 years, approximately 9,493 houses were affected; 5,996 of these were affected by floods, 1,256 by rainfall and 1,283 by strong winds. Moreover, drinking water and basic sanitation services were interrupted on 17 occasions due to landslides and flooding.

[12] PRODUCE. (2020). Diagnóstico de vulnerabilidad actual del sector pesquero y acuícola frente al cambio Climático. Retrieved from https://www.produce.gob.pe/documentos/pesca/dgsp/publicaciones/diagostico-pesquero/Tomo-2.pdf

[13] Ministerio del Ambiente. (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático Retrieved from: https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf

Figure 6. Mudslide in Huanuco in 2020. Source: RPP, 2020

1.20. SENAMHI (2013) prepared a technical study on average temperature and precipitation trends, addressing the intensity and frequency parameters of extreme hydroclimatic events, and identifying the relationship between these changes and global warming and/or climatic phenomena that control the climate of the Huanuco region. Below is an outline of trends, indices of extreme events and emergencies associated with climate change addressed in this study:

- **Trends and indices of extreme precipitation events**: The analysis of precipitation trends lacks consistency; the meteorological stations that served as the basis for the study (Tingo María, Huanuco, Jacas Chico) show increases, as well as decreases in annual precipitation. Rather than being caused by climate change, the observed changes are mainly associated with the high variability of the spatial distribution and amount of rainfall due to its complex orography and high temporal variability. Figure 7 presents the annual and seasonal precipitation trends observed at representative stations in the region from 1965 to 2012. The 99% significance values are shown in bold.

Figure 7. Annual and seasonal precipitation trends (mm) and 99% significance (in bold) in some localities of the Huanuco region (1965-2012). Source: SENAMHI (2013)

	Estaciones	Período	Tendencia Anual	Tendencia Verano DEF	Tendencia Otoño MAM	Tendencia Invierno JJA	Tendencia Primavera SON
Tendencia Precipitación (mm/década)	Tingo María	1965-2012	1.85	36.05	23.90	-11.17	-26.53
	Huánuco	1965-2012	0.29	-3.71	3.81	0.00	0.80
	Jacas Chico	1975-2012	**116.41**	30.68	**36.40**	**9.83**	20.81

DEF: período de mayores precipitaciones Diciembre-Enero Febrero, JJA: período de menores precipitaciones Junio-Julio-Agosto, SON: Setiembre-Octubre-Noviembre

- **Trends and indices of extreme temperature events:** Trends and indices of extreme temperature events: There are clear signs of increasing maximum and minimum temperatures in the Huanuco region, which are consistent with current global trends. Figure 8 presents annual and seasonal trends of maximum and minimum air temperatures for 1965-2012 at 99% confidence.

Figure 8. Annual trend of maximum and minimum temperatures (°C) and 99% significance (in bold) in some localities of the Huanuco region (1965-2012) Source: SENAMHI (2013)

Tendencias	Estaciones	Período	Tendencia Anual	Tendencia Verano DEF	Tendencia Otoño MAM	Tendencia Invierno JJA	Tendencia Primavera SON
Tendencia Temperatura Máxima (°C/década)	Tingo María	1965-2012	0.02	0.09	0.04	0.0	0.02
	Huánuco	1965-2012	**0.16**	**0.18**	0.14	**0.14**	**0.17**
	Jacas Chico	1975-2012	**-1.0**	**-1.4**	**-0.88**	**-1.09**	**-0.71**
Tendencia Temperatura Mínima (°C/década)	Tingo María	1965-2012	**0.15**	0.17	**0.18**	0.08	0.13
	Huánuco	1965-2012	**0.25**	**0.32**	**0.30**	**0.21**	**0.33**
	Jacas Chico	1975-2012	0.07	0.38	0.22	**-0.46**	0.20

DEF: Período de mayores precipitaciones Diciembre-Enero Febrero, JJA: período de menores precipitaciones Junio-Julio-Agosto, SON: Setiembre-Octubre-Noviembre

- **Climatic and hydroclimatic hazards that caused emergencies:** Between 2003 and 2012, there were 1,301 hydro-climatic events causing damage or losses to people, social and road infrastructures or damage to the productive sector. The most frequent extreme events in the Huanuco region include

rainfall (354 events, 27%), **strong winds** (281 events, 22%), **frost** (195 events, 15%) and **floods** (187 events, 14%) (INDECI-SINPAD, 2013). The provinces with the highest recurrence of extreme events that turned into emergencies are Huanuco, with 333 occurrences, Puerto Inca, with 181 events and Yarowilca, with 152 events.

1.21. Regarding new weather patterns and extreme events, there have been changes related to their frequency, seasonality, and duration. According to MINAGRI (2012), the region's frequency of extreme weather events has suffered variations. The climatic events that have sustained the most significant changes are droughts, cold spells, and frosts, occurring in more months of the year. On the other hand, the intensity of climatic events has varied considerably.

1.22. According to the distribution of extreme weather events in different ecoregions, the following are the districts with the highest exposure:

- **Precipitation:** Puna ecoregion: Arancay, Canchabamba, Chavinillo, Cholón, Obas, S. María del Valle; Ecorregión Selva Alta: Amarilis, Ambo, Chaglla, Chinchao, Churubamba, Huanuco, Quisqui, Tomaykichwa.
- **Frost:** Puna ecoregion: Chaulan, Chavín de Pariarca, Aparicio, Pomares, Chavinillo, Huacaybamba, Llata Margos, Obas, San Rafael Baños, Jesús, Jivia, Queropalca, San Miguel de Cauri, Cayna, Colpas, Chuquis; La Unión, Marías, Pachas, Ripan, Shunqui, Yanas, Sillapata; Selva Alta Ecoregion.
- **Floods:** Puna Ecoregion: Cholón; Selva Alta Ecoregion: Amarilis, Ambo, Chinchao, Daniel Alomias Robles, Hermilio Valdizan, Huanuco, Jose Crespo y Castillo, M. Damaso Beraún, Monzón, Padre Felipe Luyando, Rupa; Ecorregión Selva Baja: Codo, Honoria, Puerto Inca, Tournavista, Yuyapichis.

1.23. Regarding precipitation projections, according to SENAMHI (2013) estimates, in the pessimistic scenario of GHG emissions (RCP8.5), annual precipitation would increase by up to 5% in the lowland rainforest and by 6%-10% in the highland rainforest and the Andean zone of Huanuco by 2030. Regarding temperature projections, it is estimated that the annual maximum temperature in 2030 will increase across the Huanuco region by up to 1.6 °C. The minimum temperature will behave similarly in the region's three sectors, increasing by up to 1.6°C. In both cases, the comparisons are made vis-à-vis figures for 1971-2000.

A.1.2. Junin's climatic context

1.24. In Junin, total annual precipitation increases as altitude increases in the region's central and western areas, as local differences are closely related to valley-mountain breeze systems. In the *eastern region*, the opposite occurs; total annual precipitation decreases with altitude, and rain becomes more intensive in low rainforest areas with essentially convective processes. The average rainfall regime for the localities located in the *inter-Andean* valleys begins in July. It gradually increases in August and September, becoming more significant in October and reaching a maximum point in February. The months of maximum precipitation are between January and March; in April, precipitation decreases significantly, reaching a minimum point in June. The rainfall regime in the localities of the rainforest is more active and has a better seasonal distribution. Rains begin in August and gradually increase until reaching a maximum point in January. The months with the highest rainfall are between December and March, and it falls sharply in April.

1.25. Between January and March 2007, floods and landslides[14] occurred as a result of intense rains in different localities of the departments located in the central highlands such as Huanuco, Pasco and Huancavelica. This also occurred in the Junin rainforest, where the Perene, Huatziroki and Satipo rivers overflowed and activated the Huacara stream, affecting towns and districts in Chanchamayo, Concepción and Satipo provinces. In this same period, 2,289 victims were registered in Junin; 9,185 people were affected and 13 died (INDECI, 2020).

1.26. Districts with the highest risk are highly exposed to weather events that affect people's health. This occurs in San Jose de Quero, Huasicancha, San Juan de Jarpa, Yanacancha, Chongos Alto, Ricran, Suitucancha, Pariahuanca, Marcapomacocha and Andamarca. The greatest negative impacts on human health have been reported in the provinces of Huancayo, Jauja, Chanchamayo and Satipo, followed by the provinces of Junin, Concepción, Tarma, Chupaca and Yauli.

1.27. Likewise, districts with low life expectancy at birth and high chronic malnutrition rates are highly vulnerable; for example, San Jose de Quero, Huasicancha, San Juan de Jarpa, Yanacancha, Chongos Alto, Ricran, Suitucancha, Pariahuanca, Marcapomacocha and Andamarca.

1.28. Recent weather events that have caused damage to homes include heavy rains, followed by floods, snowfall, and to a lesser extent, landslides, and frost. Based on the predominant construction materials, the most

[14] Huaicos or lloclla, which mean ravine in Quechua, are alluviums and mudslides that generate a violent displacement of a large mass of muddy water, mud, and stones. These phenomena are common in Peru.

vulnerable homes are located in the districts of Santa Barbara de Carhuacayan, Huertas, Tres de Diciembre, Huancan, Rio Negro, Matahuasi, Marcapomacocha, Carhuamayo, Nueve de Julio and Pilcomayo.

1.29. Infrastructure for safe water supply for human consumption is most vulnerable to climate change in the following districts: Nueve De Julio, Sicaya, Matahuasi, Tres De Diciembre, Pancan, Sausa, Concepción, Pilcomayo, Chupaca and San Lorenzo.

1.30. Home sanitation infrastructure is most vulnerable to climate change in the districts of Tres De Diciembre, Matahuasi, Pancan, Huertas, Nueve de Julio, Huachac, Huasicancha, San Lorenzo, Huamancaca Chico, Ataura.

1.31. The Junin region does not have detailed studies on annual and seasonal climate trends: however, the study *Eventos meteorológicos extremos (sequías, heladas y lluvias intensas en el valle del Mantaro)* (Instituto Geofísico del Perú, 2012) provides the following information for the period 1922-2010:

- **Temperature**: Annual average maximum air temperature has increased by 0.12°C/decade after 1976. It has increased up to +0.28°C/decade in winter and 0.24°C/decade in autumn. Minimum air temperature shows a slightly significant decrease in winter and spring (0.08 and 0.07 °C/decade), but between 1976-2010, it has increased to 0.30 °C/decade in autumn.
- **Precipitation**: Slightly decreasing annual trends. However, for autumn the trend is 2.3%/decade. It has decreased up to -10.3% in autumn, -7.6%/decade in spring, -5.1%/decade in summer and -6.6% for the rainy period (September-April).
- **Heavy rainfall**: On average, there are 14 events per year, with a variability of +/- 4 days, and it has decreased to 11.6 events per year in the last decade.
- **Frosts**: Between the 1920s and 1950s, the first frosts occurred only between April and June, but from 1960 onwards, they also started between mid-February and the end of March.

1.32. According to data from the National Information System for Response and Rehabilitation (*Sistema de Información Nacional para la Respuesta y Rehabilitación*- INDECI 2014), between 2003 and 2013, frost, heavy rains and strong winds were extreme events that caused major emergencies and disasters in the department of Junin, damaging human health and infrastructure and disrupting economic activities.

1.33. Furthermore, between 2003 and 2013, the provinces of Tarma and Jauja in the Junin region registered the highest number of irrigation canals affected and collapsed by weather-related events, followed by the provinces of Concepción, Chanchamayo and Huancayo. At the same time, the province of Jauja registered the largest number of reservoirs affected and collapsed by weather-related events, followed by the provinces of Tarma, Huancayo and Junin.

1.34. The provinces of Chanchamayo and Huancayo recorded the most significant negative impacts of weather-related events, which caused damage to highways and rural roads. In this period (2003-2013), 1,121.14 km of roads were affected, 151.30 km of roads collapsed, 375.92 km of rural roads were affected, and 98.03 km of rural roads collapsed.

1.35. According to the Junin Regional Climate Change Strategy (2017), the climate projection for 2030 appear as follows:

- **Minimum temperature in 2030**: Two scenarios were prepared to estimate the minimum air temperature in 2030. One scenario corresponds to the future climate scenario in the Mantaro basin, and the other corresponds to the future national climate scenario, which includes two well-defined areas with sharply contrasting temperatures. The southeastern area, comprising the districts of Andamarca, Santo Domingo de Acobamba, and part of the San Martin de Pangoa, has high temperatures. In contrast, the north-western area, comprising the districts of Marcapomacocha, Santa Barbara de Carhuacayan, and Yauli, has low temperatures. In the rainforest, high temperatures are found in the eastern part, bordering the department of Ucayali, and low temperatures prevail in Monobamba and Chanchamayo.
- **Maximum temperature in 2030**: Two scenarios were prepared to estimate the maximum air temperature in 2030. One scenario corresponds to the future climate scenario in the Mantaro basin, and the other corresponds to the future national climate scenario, which includes two well-defined areas with sharply contrasting temperatures. The southeastern region, comprising the districts of Santo Domingo de Acobamba and San Martin de Pangoa, has high temperatures. In contrast, the north-western area, including the districts of Marcapomacocha, Santa Barbara de Carhuacayan, Yauli and Canchayllo, has low temperatures. Meanwhile, in the rainforest, high temperatures can be observed in the eastern part, bordering the department of Ucayali, and low temperatures in Monobamba and Chanchamayo.
- **Cumulative annual precipitation by 2030:** Two scenarios were prepared; one scenario corresponds to the future climate scenario in the Mantaro basin, and the other corresponds to the future national climate scenario. The maximum precipitation in the Mantaro basin occurs in the southeastern area, in the district

of Santo de Acobamba, and a part of the district of San Martin de Pangoa. The minimum precipitation occurs in the western region of the Mantaro basin. In the rainforest, the maximum precipitation occurs in most of the central rainforest area, and the minimum precipitation is found in part of the Tarma area.

A.1.3. Climatic context of Puno

1.36. Due to Puno's location in the southern Andean region of the Cordillera, the climate ranges from predominantly dry frigid (during autumn and winter) to temperate humid (during spring - summer) on the shores of the lake. The climate is warm in the rainforest, with maximum temperatures ranging between 14°C and 30°C and minimum temperatures between -6°C and 18°C.

1.37. The Department of Puno has areas facing a high and very high risk of disasters due to multiple hydrometeorological, atmospheric, and climatic hazards that affect residents, their livelihoods, and essential services. Emergencies by type of hazard in the Department of Puno show that high temperatures and heavy rainfall cause more than 60% of phenomena associated with hydrometeorological hazards. Territories with a heterogeneous morphology are subject to low temperatures, droughts, electrical storms, snowfall, hailstorms, strong winds, lightning, and floods of fluvial origin.

1.38. In Puno, the El Niño phenomenon and heavy rains have increased the discharge of rivers that flow into Lake Titicaca with waste and pollutants that affect the production of hydrobiological resources.

1.39. Floods are the second major risk in the Department of Puno. Most floods are linked to increases in the dynamic levels of lakes, lagoons, and events related to river flooding in the Amazon region. They are caused by heavy rains, often accompanied by snowfall and hailstorms, causing rivers (Ramis) and lakes (Titicaca) to swell. The provinces affected by Lake Titicaca floods are Huancane, San Roman, Puno, El Collao, Chucuito, and Yunguyo. Riverine floods occur in rainforest areas, mainly in Sandia, Carabaya and Melgar.

1.40. According to SENAMHI, strong winds exceeding 35 km/hour, and sometimes 40 km/hour, have been recorded in Puno, causing damage to crops. In the rainforest, they have uprooted trees, damaged the roofs of houses, produced abortions in animals and, in Lake Titicaca, they have affected aquaculture production, as they overturn or destroy fish farming cages.

1.41. According to the *Plan Regional de Gestión del Riesgo de Desastres 2016-2021 (*Regional Disaster Risk Management Plan 2016-2021, Regional Government of Puno), in 2003-2015, there were more than 3,000 emergencies in the Department of Puno, causing almost 100,000 victims, leaving 1.5 million people affected, and more than 100 deaths. In terms of damage to private and public infrastructure, almost 11,000 homes were destroyed, and more than 60,000 homes were affected. Over 600 schools and 158 health centers were affected, and more than 300,000 hectares were affected and destroyed (SINPAD, 2016).

1.42. On January 1, 2004, the Highland area suffered intense rainfall and climatic changes for more than three months, which caused river overflows and an increase in the level of Lake Titicaca. According to INDECI statistics, there were 7,333 victims, 1,350 homes were affected, and 3,376 hectares of crops were lost.

1.43. The average rainfall in the department of Puno ranges between 500 mm – 6,000 mm. In the 2030 climate change scenario, rainfall ranges between 350 mm and -3,500 mm. There is evidence of a strong rainfall deficit for the usual average in the department, which will dangerously accentuate periods of low water and drought. Water-intensive crops will likely suffer water stress, impacting the principal crops and farmed pastures. Development models based on livestock that use farmed pastures could generate social conflicts over water in communities with scarce water resources.

A.2. Climatic context and its impact on rainbow trout farming

1.44. According to the report "*Avances del Perú en la Adaptación al Cambio Climatico del Sector Pesquero y del Ecosistema Marino-Costero*" (Peru's Progress in the Fishing Sector and the Marine-Coastal Ecosystem's Climatic Adaptation PRODUCE, Instituto del Mar del Perú, IDB and MINAM, 2019)[15], temperature is a key factor that can directly and indirectly affect the biological characteristics, distribution, abundance and phenology of fishery species, as well as the yield of farmed species. The report notes the results of an ecological risk assessment (ERA) conducted to examine the relative vulnerability of selected fisheries species and some aquaculture activities to the effects of climate change (Ramos, 2017).

15 Available at: https://publications.iadb.org/publications/spanish/document/Avances_del_Per%C3%BA_en_la_adaptaci%C3%B3n_al_cambio_clim%C3%A1tico_del_sector_pesquero_y_del_ecosistema_marino-costero_es_es.pdf

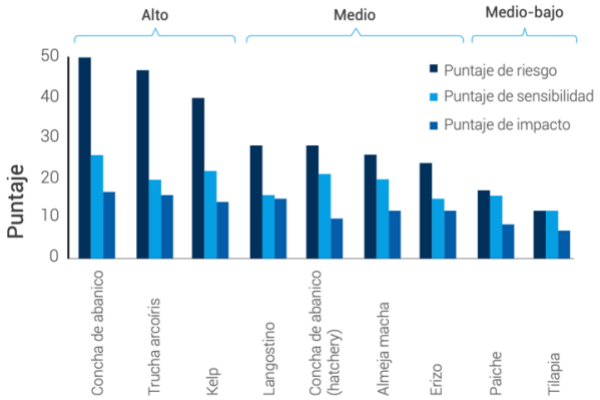
1.45. For aquaculture activities, an ad hoc methodology was used to estimate the risk scores (low, medium, high) of nine commercial or potential aquaculture activities based on their sensitivity and impact from climate change. This was done by considering nine attributes related to the availability of culture organisms in their different stages, reproduction, feeding and growth, susceptibility to disease and exposure to climate change. The cumulative sensitivity and exposure scores were ranked from highest to lowest, in an effort to define the aquaculture activities with the highest sensitivity and risk, respectively. In this study, the ecological risk assessment of the impacts of climate change on aquaculture activities concluded that based on exposure factors (temperature, frequency, and intensity of extreme events, among others) and sensitivity (availability of farmed organisms in their different states, reproduction, feeding and growth, susceptibility to contracting diseases, among others), aquaculture activities with the highest risk are scallop and **rainbow trout farming**.

1.46. The **high risk to rainbow trout** increases if there is limited availability of culture organisms, if spawning and growth of larvae and juveniles do not occur under controlled conditions, if food is not easily accessible, if culture facilities and organisms are **exposed to climate variability** and if they are prone to untreatable pathogens and diseases.

This study supports the need to allocate efforts and resources and define research lines that will provide critical information to develop relevant management plans, to minimize the risks and maximize the opportunities associated with climate change.

1.47. Although it was determined that scallop aquaculture is at the highest risk, followed by rainbow trout farming, it is important to consider that scallops are mostly sold to other countries such as Canada, Italy, New Zealand, Spain, among others, **while rainbow trout aquaculture is mostly sold to the domestic market**. This significant difference makes **rainbow trout aquaculture more vulnerable than scallop aquaculture in terms of profitability**, so improving the adaptive capacity of numerous aquaculture families dedicated to trout farming is critical. Another key element that underlines the need to strengthen the resilience of rainbow trout farming over scallop farming is the non-reimbursable economic support that international cooperation provides to scallop farming. Despite rainbow trout aquaculture's high climatic risk, it has yet to receive support from international cooperation. However, it is worth noting that although trout farming does receive support from the *Programa Nacional de Innovación Pesquera y Acuícola* (National Programme for Fisheries and Aquaculture Innovation-PNIPA), farmers must have co-financing sources to access PNIPA resources. **Fish farmers in the AREL and AMYPE production categories find it very hard to comply with this requirement. These farmers are highly vulnerable and need to improve their adaptive capacity: this project intends to address and resolve this situation.**

Figure 9. Climate risk level of farmed species in Peru 2019. Source: PRODUCE.



1.48. Extreme events exacerbated by climate change cause losses due to reduced profitability and higher insurance premiums. The impact on aquaculture productivity leads to job losses and jeopardizes the economic livelihood of aquaculture workers, especially those whose intrinsic characteristics make them more vulnerable to the effects of climate change (e.g., little diversification of aquaculture species, granted aquaculture rights, harvesting for self-consumption, the sensitivity of species to threats exacerbated by climate change). Finally, the alteration and loss of hydrobiological resources due to changes in climate patterns will affect the Peruvian population's food security.

Figure 10. Flooding and landslides affect trout ponds. Source: Peruvian News Agency.

1.49. For example, in the Puno region, strong winds on Lake Titicaca generate losses in trout farms. In 2019, Puno's Regional Directorate of Production (*Dirección Regional de la Producción*-DIREPRO) stated that estimated economic losses amounted to 40% of the total trout production in the region[16]. Specifically, official sources estimated that 410 trout producers from 11 aquaculture associations in the Puno region lost around 5 million soles due to the mortality of 160 thousand trout units weighing approximately 40 tons. According to the National Service of Meteorology and Hydrology SENAMHI, strong winds in 2019 reached speeds of 60 to 80 kilometers per hour, causing the cages used to raise trout in Lake Titicaca to tip over and break, allowing the fish to escape into the lake and die.

Figure 11. Strong waves caused by intense winds destroyed trout farms in Lake Titicaca, Puno.

1.50. In 2016, the DIREPRO of Puno declared that the El Niño phenomenon was responsible for 50%-80% of trout mortality in the region during the first half of the year, mainly due to damage to floating cages. The El Niño phenomenon mainly affected the young fry (newly hatched) because the water temperature, usually 13ºC, increased by one or two points, leading to a decrease in oxygen availability[17].

1.51. This situation, caused by strong winds and waves, constantly occurs in Lake Titicaca. In 2012, around 500 tons of trout were lost due to the destruction of floating cages installed in Chucuito, Juli, Pomata, Ilave and Yunguyo. Climate change has caused the water of Lake Titicaca to become warmer and as a result, 60% of trout production, mainly fry and juveniles died. Also, in addition to the warmer water of Lake Titicaca, there have been strong winds, such as those in 2019, which reached speeds of approximately 70 km/hour, destroying cages and generating losses to fish farmers of roughly 12 million soles[18].

1.52. In Junin, rainfall is expected to decrease due to climate change. According to IGP (2005), this is because there may be an inter-annual variation in the intensity of rainfall cycles. Thus, the stress caused by suspended solids in the water that "feeds" the trout culture ponds could be lower than in other rainy seasons[19].

1.53. In 2019, the Huallaga River overflowed its banks in the province of Ambo, department of Huanuco, destroying various infrastructures, including those related to aquaculture[20].

1.54. Agriculture absorbs a disproportionate share of disasters. According to FAO global data, between 2007 and 2018, agriculture and its subsectors, including aquaculture, absorbed 26% of the impact caused by medium- and large-scale disasters, including those associated with climate change. In Latin America and the Caribbean, losses reached US$29 billion

[16] https://elcomercio.pe/peru/puno/puno-fuertes-vientos-lago-titicaca-generan-perdidas-criaderos-trucha-noticia-658909-noticia/?foto=3
[17] https://aquahoy.com/fenomeno-de-el-nino-deja-80-de-perdidas-en-truchas/
[18] https://radioondaazul.com/region-puno-mas-del-60-de-alevinos-y-juveniles-de-trucha-mueren-por-el-cambio-climatico/ and Official document 690-2022-PUNO/DIREPRO
[19] https://cybertesis.unmsm.edu.pe/bitstream/handle/20.500.12672/1563/Janampa_sp.pdf?sequence=1&isAllowed=y
[20] https://elcomercio.pe/peru/huanuco/huanuco-rio-huallaga-desborda-provincia-ambo-video-noticia-nndc-617173-noticia/

B. Socioeconomic context

1.55. According to the Peruvian Institute of Economics (Instituto Peruano de Economía- IPE, 2021), poverty increased by 31% in the country's southern area as a result of the 2020 coronavirus pandemic. This means that half a million people fell below the poverty threshold. Poverty rates increased by 10% nationally, breaking a declining trend that started in 2004. The pandemic led to more acute impoverishment in urban areas, as the population in rural areas continued with their productive activities, such as agriculture. Nonetheless, rural areas continue to suffer from higher poverty rates. In 2021, Peru's regions with the highest levels of poverty were Puno (42.6%), Pasco (42.1%) and Huancavelica (41.2%). The poverty rate in Huanuco was estimated at 35.5% and in Junin, 26.4%.

1.56. According to the National Household Survey, in the second quarter of 2020, the employed population decreased by more than 6 million people compared to the same period in 2019. The largest increases in the unemployment rate were recorded for men aged 25-44 and people with non-university tertiary education. Between July 2019 and June 2020, the informal employment rate rose to 74.3%.

1.57. Regarding aquaculture, this activity generated just over 102,000 direct and indirect jobs in 2015. Considering that each worker is responsible for three dependents, on average, it is estimated that Peruvian aquaculture guarantees the livelihood of at least 300,000 people.

1.58. The last aquaculture census in 2013 highlights that 68% of producers lack the authorization to develop their activity, meaning that they are informal producers. It also shows that most aquaculture producers are engaged in monoculture (85%) and 73% in subsistence production. It should also be noted that 93% of aquaculture producers are natural persons. The predominant age of aquaculture producers is between 30 and 44 years old, most of whom have completed secondary education and own their own homes.

1.59. In In vulnerable communities, there are often good conditions for aquaculture. This activity represents an opportunity to reduce the pressure on natural aquatic resources, with minimal environmental impact and helps provide fish to improve local populations' diet and economy[21].

1.60. Aquaculture involves all family members and engages women and young adults who become economically active. Furthermore, aquaculture can contribute to family integration, as the elderly can also participate by carrying out simple tasks. Therefore, this activity does not require workers to have theoretical knowledge; only practice and experience gained over the years are essential.

1.61. Regarding financial inclusion, based on information from the survey conducted by Mendoza (2015), access to credit in Peru is determined by factors closely linked to the lack of knowledge of financing sources available in the public and private sectors.

B.1. Social Context of the Huanuco Region[22]

1.62. Huanuco is located in the country's central Andean-Amazonian region. It includes Andean territory from the Quechua region to the Puna or Jalca region, the high jungle or Rupa Rupa and the low jungle or Omagua. It covers an area of 36,848 km2 (2.87% of the national total), with two natural regions, the highlands with 22,012 km2, and the jungle and jungle area, with 14,837 km^2. The department of Huanuco is located in the range of 80 to 6,334 meters above sea level. It is located in the snow-covered Yerupaja mountain, on the border between Huanuco and Ancash, in the White Mountain range. It is Peru's second-highest peak, after Huascaran. It is bordered to the north by La Libertad, San Martin, and Loreto, south by Pasco, east by Ucayali, and west by Ancash and Lima. It is also divided into 11 provinces and 84 districts.

1.63. The Huanuco region has a population of 860,537, with an urban population of 332,012 (38.58%) and a rural population of 528,525, 61.42% of the department's total population (INEI, 2007).

1.64. Based on the 2006 Human Development Index prepared by the United Nations Development Programme (UNDP), the department of Huanuco ranks in the 21st position nationally, an HDI of 0.5468, evidencing it is one of the poorest departments in Peru.

1.65. The coverage of basic services is below the national average. In 2010, coverage of basic sanitation services was only 73% in the Huanuco region.

1.66. According to INEI data, poverty in Huanuco increased sharply, from 29.4% in 2019 to 42.6% in 2020. In 2020, in the context of the pandemic, poverty in Huanuco increased by 13 percentage points. This represented a seven-year setback in the level of poverty in the region. This increase was slightly higher in

[21] Leisa, Revista de Agroecología, Volume 21, number 3
[22] The analysis on the social context is based on Huanuco's Regional Development Plan 2014-2021 https://www.fao.org/3/i5731s/i5731s.pdf

the rural area (from 37% to 52%) than in the urban area (from 18% to 29%). Likewise, the level of extreme poverty in the region suffered a stronger increase in rural areas (from 5.9% to 16.4%) than in urban areas (from 0.2% to 5.8%). The provinces with the highest percentage of poverty are: Pachitea 80.2%, Yarowilca 78.4% and Dos De Mayo with 78.4% poverty rates, respectively. Provinces with the highest extreme poverty rates are Pachitea (52.8%) and Yarowilca (51.4%), respectively.

1.67. Regarding the highest level of education attained by the inhabitants of Huanuco, 59% of poor people have achieved, at most, primary education or less. In comparison, this figure is 43% for non-poor people. Similarly, only 8% of the impoverished population has completed higher education, while the figure for non-poor people is 29%. Although regional illiteracy rates have dropped slightly, they are still high, as 18% of the population older than 15 is illiterate.

1.68. The economically active population (EAP) older than 14 is estimated at 247,699, of which 27% are women and 73% are men. The province of Huanuco accounts for 38% of the EAP, followed by Leoncio Prado with 18%. The provinces of Ambo, Huamalies and Pachitea contribute 7%-8%; Dos de Mayo, Puerto Inca, Lauricocha and Yarowilca contribute 4%-5%; and the provinces of Huacaybamba and Marañón between 2% and 3% of the EAP. Informal employment in Huanuco increased from 86.6% in 2019 to 88.2% in 2020, showing a deterioration of the labor market. In this respect, there is a clear relationship between poverty and informality. In 2020, 98.5% of poor people had informal jobs; for non-poor people, this figure was 81.9% (IPE, 2021)[23].

1.69. Regarding child health, according to WHO, chronic malnutrition in children under 5 affects boys more frequently (43%) than girls (35%), with a gap of -7.7% in favor of girls. Anemia also affects boys more frequently (50%) than girls (45%). Between 2019 and 2021, anemia decreased from 40.1% to 38.8% in Peru; in Huanuco, it increased from 39.1% to 40.3%. Thus, Huanuco is one of the 14 regions where the percentage of children 6-35 months old with anemia increased during this period. Huanuco also ranks thirteenth among the regions with the highest prevalence of anemia at the national level, and sixth in the central macro-region, which encompasses Ancash, Ayacucho, Huancavelica, Huanuco, Ica, Junin, Lima provinces and Pasco (IPE, 2022).

1.70. The availability of nutritious food is fundamental to ensure food security. In this regard, the Ministry of Development and Social Inclusion (MIDIS, 2022) assessed food security in Peru, considering food availability, access, utilization, and stability. It found that 54.2% of households in Huanuco suffer from food insecurity, which is higher than the national figure (51.0%).

B.2. Social Context of the Junin Region

1.71. The department of Junin is located in central Peru, comprising two natural regions: the highlands (46%) and the forest (54%). To the north, it borders the departments of Pasco and Ucayali, to the south with Huancavelica and Ayacucho, to the west with Lima, and to the east with Ucayali and Cusco.

1.72. According to the 2007 National Census, Junin's population is 1,225,474, 67.3% of which live in urban areas and the remaining 32.7% in rural areas. Men account for 49.8% of the population, while women account for 50.2%. It should be noted that approximately 60.9% of the population is between 15 and 64 years old (INEI 2007).

1.73. In 2009, the Junin population suffers from poverty and extreme poverty; the poverty rate in urban areas was 32%, and in rural areas, 42% (INEI 2009). In 2013, it was in the fourth group with a poverty rate ranging from 18.8 to 14.7, together with the following departments: Ancash, Cusco, Lambayeque (INEI 2013). According to the UNDP Human Development Index (2012), Junin is classified as a department with Low Human Development (HDI of 0.45).

1.74. The literacy rate among individuals over 15 years old is 92.4%, meaning that 7.6% of the population is unable to read and write (INEI 2007).

1.75. The Economically Active Population (EAP), aged 14 and over, is estimated at 457,691 people, 95.9% employed and 4.1% unemployed (INEI 2007).

1.76. Regarding access to water and sanitation, in Junin, 50.9% of households are supplied with drinking water by a public network inside the home, 8.4% receive water from a public network outside the home but inside the building, and 1.7% of households receive water from a public standpipe (2007).

1.77. The impacts of climate-related events or hazards, such as heavy rains, frost, snowfall, mass movements and floods, evidence a significant exposure to drinking water and sanitation infrastructure hazards. The most

[23] https://www.ipe.org.pe/portal/huanuco-el-impacto-de-la-pandemia-ocasiono-un-retroceso-en-la-pobreza-hasta-niveles-del-2013/

affected provinces are Huancayo, Chanchamayo, Satipo and Jauja, with more than 12,000 houses affected. In the department of Junin, structural conditions reduce this sector's adaptive capacity to climate-related events, which are mentioned below: 43.7% of the houses are made of adobe or rammed earth, 14.2% of wood and 36.1% of brick or cement block. Floors are made of dirt (53.2%), planked wood (6.9%) and cement (33.6%) (INEI 2007). There are human settlements, new villages and sanitation systems located in areas at risk. The water networks installed still need to be improved.

1.78. In terms of child health, the prevalence of chronic malnutrition in children under five has improved, although it is still relatively high. Between 2007 and 2013, there was a decrease in the malnutrition rate from 31.9% to 24.2%.

B.3. Social context of the Puno region[24]

1.79. The Puno region is located in the highlands between 3,812 and 5,500 meters above sea level and between the forest brow and high forest between 4,200 and 500 meters above sea level. The capital of the department is the city of Puno, located on the shores of Lake Titicaca.

1.80. According to the 2007 National Population and Housing Census projections for 2015, the Puno region has 1,415,608 inhabitants, of which 54% are concentrated in urban areas and participate in secondary and tertiary activities, and 46% are distributed in rural areas.

1.81. According to the National Household Survey (2012) the department has a 10.5% illiteracy rate, corresponding to the population at least 15 years old. This figure is higher than the national average of 6.2%.

1.82. Puno is among Peru's poorest regions. Between 2004 and 2006 it was the second poorest after Huancavelica, with 76.3% of its population living in poverty and 41.6% in extreme poverty in 2006. This situation is a consequence of underemployment and unemployment, given that most of the population is dedicated to agricultural activity, which is vulnerable to the effects of climate change.

1.83. Basic services such as electricity, water and sanitation in the Puno region are insufficient to meet the needs of the population. Access to these services is below the national coverage: access to electricity at home is 60.1%; access to drinking water at home is 40.7% and access to drainage or sanitation services is 24.6%.

1.84. From ancient times to the present day, Lake Titicaca's natural resources have allowed the development of important adjacent towns and ensured the survival of their inhabitants, providing not only goods for immediate use but also environmental services that have improved climatic conditions for their productive activities. Of all the resources Lake Titicaca provides, fish constitute a primary food source for surrounding populations. It is often the most important protein source in their diet, which is why traditional artisanal fishing and aquaculture remain relevant.

1.85. Rainbow trout is one of Puno region's flagship products, and this region has become the first producer nationwide. The Puno region has great potential for water resources. From an ecological and socioeconomic perspective and the standpoint of aquaculture, Lake Titicaca is the most critical resource in the highlands. The lake's environmental conditions and socioeconomic viability for rainbow trout farming have enabled its recent development to support one of the region's major productive activities. Moreover, it includes the Inambari and Tambopata basins which are part of the Amazon slope and hold relevant possibilities for aquaculture.

B.4. Gender in Peruvian aquaculture

1.86. In Peru, various sources of information enable assessing women's participation in fisheries and aquaculture. It is estimated that there are around 8,000 women in these activities (FAO, 2016). The National Aquaculture Register, which is administered by the Ministry of Production, reports that 27 marine aquaculture rights were granted to natural persons in February 2015, of which 24 correspond to men and only 3 to women, a figure that represents only 11% of the rights granted to natural persons.

1.87. According to the survey conducted by Mendoza (2015) focusing on the fishing production chain, it was found that women are a majority in primary and secondary processing in aquaculture but are a minority in fishing activities. The participation of women in the production or farming area in aquaculture is very low (8 %), but

[24] Puno Regional Government. Regional Development Plan agreed on 2021. https://www.regionpuno.gob.pe/descargas/presupuestoparticipativo/consolidado_plan_concertado_2021.pdf

they are three out of ten workers in the marketing area, more than half in primary processing and about nine out of ten in secondary processing.[25]

Figure 12. Percentage of men and women who work in aquaculture and fishing companies in Peru, by area of work. 2015

Área	Acuicultura (%)		Pesca (%)	
	Hombres	Mujeres	Hombres	Mujeres
Producción, cultivo o extracción	92	8	100	-
Procesamiento primario	42	58	78	22
Procesamiento secundario	12	88	89	11
Comercialización	67	33	60	40

Fuente: Elaboración propia con base en encuesta realizada por Mendoza (2015), para Perú.

1.88. Ninety-two percent of jobs in aquaculture production or farming activities are held by men and 8% by women; 60% of primary processing jobs are held by women and 40% by men; likewise, in secondary processing, 70% of jobs are held by women and 30% by men; 68% of commercialization jobs are held by men and 32% by women. Although women play an essential role and hold the majority of aquaculture processing jobs, many of these are casual and seasonal, thereby generating economic insecurity and low coverage of social protection systems for women (health insurance, severance pay, pension contributions, etc.) (FAO, 2016).

1.89. According to Mendoza's study (2015), which analyses forty companies in Peru, access to permanent or temporary work is different for men than for women, and these differences are significant for aquaculture or fishing companies. Most permanent jobs are reserved for men, and in the case of fishing companies, also temporary jobs. Available information also shows that there are more job opportunities for women in aquaculture enterprises than in fishing companies and that casual work is more common for women than men. Overall, only 29% of jobs are held by women and only 21% of permanent jobs are held by women. According to the type of enterprise, 40% of jobs in aquaculture companies and 14% in fishing companies are in the hands of women.

1.90. Information from the Peruvian census at the continental level (CEMPAR, 2013) shows that 2% of women fisherwomen and 17% of women fish farmers have resorted to financing from external sources for the development of their productive activities. Concerning access to financing, there need to be more financial products in Peru adapted to the characteristics and conditions of women fisherwomen and fish farmers (FAO, 2016).

1.91. There is little participation of women in the sector's organizations, which have traditionally included only men, and new spaces have been slow to open to women, not only because men hold power and run internal dynamics in the organizations but also because some women do not believe they are capable or motivated to enter these spaces.

1.92. Existing limitations in the availability of statistical information disaggregated by sex make it impossible to learn about the characteristics, situation, and particular conditions of women fish farmers. This situation keeps women in the sector invisible, thereby affecting the definition of public policies, decision-making and the implementation of initiatives for women's economic and social empowerment.

C. Economic context of aquaculture in Peru

1.93. In 2020, the government's restrictive measures to mitigate the effects of the pandemic at the national level were reflected in the negative performance of the gross value added of almost all the country's departments (INEI, 2021). Peru's Gross Domestic Product (GDP) contracted by 11.1% in 2020, generating huge job losses and declines in labor participation, especially among women, increasing informality and poverty. Nationally, 2.2 million jobs were lost. Labor informality increased by 2.6 percentage points, reaching 75.3% (the highest since 2010). The incidence of poverty at the national level rose by 9.9 percentage points, reaching 30.1% of the population. In absolute terms, the pandemic increased the number of individuals suffering from poverty by 3.3 million. During 2021, economic activity recovered to its pre-pandemic level (2019), however, employment has not improved at the same pace (CAF, 2022).

1.94. At a departmental level, in 2020 GDP declined in twenty-three departments. In the following eleven departments, the contraction of the GDP was stronger than at the national level: Madre de Dios (-24.2%),

[25] Organización de las Naciones Unidas para la Alimentación y la Agricultura (2016). *El rol de la mujer en la pesca y la acuicultura en Chile, Colombia, Paraguay y Perú*. Retrieved from https://www.fao.org/3/i5731s/i5731s.pdf

Pasco (-18.5%), Arequipa (-15.7%), Loreto, (-13.9%), Tumbes (-13.7%), Ucayali and Ayacucho (-13.0% each), Cusco (-12.4%), Lima decreased by -11.9%, Ica (-11.6%), Puno (-11.2%) and Huanuco (-11%). Among the Peruvian population[26], 54.2% suffer from economic vulnerability. At the provincial level, 10 of 25 regional governments, economic vulnerability affects between 50% and 75% of the population. Additionally, 18% of the national population lives in 1,153 districts with high or very high vulnerability to food insecurity due to the recurrence of natural and climatic phenomena.

1.95. In this context, the economic and social crisis is exacerbated by the climate crisis caused by the increase in average temperature, and prolonged droughts, landslides and floods produced by frequent heavy rains, among other events.

1.96. Peru's biodiversity resources and ecosystem services affect economic performance and contribute approximately 15-20% of GDP. About one-third of the population (2.2 million rural households) strongly depend on these goods and services for their livelihoods. In addition, about 65 % of the national agriculture and a large part of the gastronomy business (which moves 9.5 % of the Peruvian GDP) depends on native genetic resources[27] (MINAM, 2021).

1.97. Aquaculture has been declared a national interest activity by PRODUCE, as it has the potential to improve food security and alleviate poverty, especially in rural areas; therefore, significant efforts to adapt to climate change are needed.

C.1. Classification of aquaculture producers in Peru

1.98. Aquaculture is classified according into the following productive categories:

- **Medium and Large Enterprise Aquaculture (AMYGE):** this activity is carried out for commercial purposes by natural or legal persons. The annual production of AMYGEs is greater than 150 gross tons.
- **Micro and Small Enterprise Aquaculture (AMYPE):** this activity is carried out for commercial purposes by natural or legal persons. The annual production of AMYPE is greater than 3.5 gross tons and does not exceed 150 gross tons. This category includes research authorizations, seed production centers and farming of ornamental hydrobiological resources, which will be governed in accordance with their specific regulations.

  AMYPE are mainly self-employed and run by individuals with low levels of formal education who are generally highly vulnerable due to limited resources to cope with any crisis (FAO, 2018).
  The infrastructure used by AMYPEs includes rustic compacted ponds and machinery; pumping equipment and sometimes aeration; floating cages made from local or introduced rustic materials; in some cases, they may have processing and product preservation facilities.

- **Limited Resources Aquaculture (AREL):** this activity is carried out exclusively or in a complementary manner by natural persons, who must meet all the requirements established for this category. It covers the basic family food basket and is carried out mainly for self-consumption and self-employment. This category includes aquaculture activities carried out by non-commercial basic education centers. The annual production of ARELs does not exceed 3.5 gross tons. ARELs are the less competitive segments; therefore, without external support, their sustainability is threatened particularly when production costs increase and/or demand for their product decreases (FAO,2018).

1.99. Most micro and small-scale fish farmers (AMYPE) and those with limited resources (AREL) work in very precarious conditions, without adequate formalization, with poor access to available technologies and little articulation in value chains and sustainable markets.

1.100. For aquaculture to be sustainable and competitive, it needs to address a wide diversity of dimensions ranging from technological, commercial, environmental aspects, the organization of logistics and supply chains, access and financial education, human resources, and a easily accessible network of service providers, goods and services. Norms related to the formal development of the activity cannot be forgotten in this list.

1.101. According to the General Aquaculture Law, the National Fishery Health Agency (*Organismo Nacional de Sanidad Pesquera*-SANIPES) is in charge of surveillance and sanitary control in aquaculture production centers. Access to aquaculture activities for AMYGE and AMYPE requires authorization or a concession

[26] Instituto Nacional de Estadística (INEI, 2021). https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1794/libro.pdf https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1794/libro.pdf

[27] MINAM: la biodiversidad es un activo clave para el desarrollo sostenible. Available at: https://www.gob.pe/institucion/minam/noticias/497925-minam-la-biodiversidad-es-un-activo-clave-para-el-desarrollo-sostenible-del-peru

granted through a Directorial Resolution. PRODUCE grants authorizations and concessions for AMYGE, and the regional government grants authorizations for AMYPE and AREL.

1.102. According to PRODUCE, as of 2022, 12,895 rights for the development of **inland aquaculture** were registered in Peru, of which, 11,902 corresponded to authorizations and 993 to concessions. **Authorizations** allow aquaculture activities on privately owned land. **Concessions** allow aquaculture activities on public domain land, seabed or marine and inland waters.

1.103. By 2022 the following rights were granted to AMYPE, **specifically for rainbow trout farming**: for Huanuco 49, Junin 157, and Puno 523, for a total of 729 in these three regions. For the same year, the following rights were granted to **AREL, specifically for rainbow trout farming**: Huanuco 81, Junin 121 and Puno 5, for a total of 207 in these three regions. The total number of AMYPE and AREL for rainbow trout farming in the regions of Huanuco, Junin and Puno is 936. This is the main beneficiary group of the project presented in this Concept Note.

1.104. Between 2019 and 2020, the gross value added of fisheries and aquaculture grew by 3.1% (at constant 2007 prices). This growth resulted from higher landings of hydrobiological species for indirect human consumption (27.8%), attenuated by the fall in the extraction of hydrobiological resources for direct human consumption (-4.3%) (INEI, 2021).

1.105. There is a lack of knowledge and misinformation about access to competitive financing mechanisms for aquaculture projects. At the national level, aquaculture activity does not receive much attention from financial institutions and insurance companies due to past risks, such as the white spot and the El Niño phenomenon in 1997-1998, which caused substantial economic losses in the aquaculture sector. Since these events took place, financial institutions have shown little interest in offering insurance and credit to support aquaculture activities. Furthermore, the National Inland Fisheries Census (2013) evidenced that 68% of fish farmers work in informal conditions, contributing to their financial isolation. The repeal of the agrarian promotion law (Law 27360) affected the aquaculture sector, since it granted tax benefits to formal producers, such as reducing income tax from 30% to 15%.

1.106. Aquaculture producers' informality restricts their access to credits, which are not only aimed at improving their production, but also at adapting to climate change. Therefore, this places them at a greater risk from the impacts of climate change. As a result, there is vicious circle where climatic events affect aquaculture producers and also limit access to financing, as this activity is considered vulnerable to climate effects. This could lead to reduced employment opportunities in the sector and affect the livelihoods of participating actors.

1.107. Aquaculture production in Peru has increased from 10,000 tons in 2003 to over 143,000 tons in 2020, with a peak in 2019 of over 161,000 tons. By 2021, national aquaculture amounted to 144,000 tons. Due to their environmental characteristics and conditions for the development of a strong aquaculture culture, these are the country's main production regions: (i) Tumbes, the area with the strongest aquaculture activity for prawn species; (ii) Piura and Ancash for scallops; (iii) San Martin and Piura for tilapia; (iv) Junin, Huancavelica, Pasco and Puno for trout; and (v) San Martin, Loreto, Ucayali and Madre de Dios for various Amazonian fish.

C.2. Trout farming in Peru

1.108. The rainbow trout species (*Oncorhynchus mykiss*) was introduced in Peru between 1925 and 1940. It adapted optimally to the bio-ecological conditions of the aquatic environments of the high Andean zones. Since then, and due to the growth of trout farming in the high Andean zone, the Peruvian Government focused on developing trout, promoting its naturalization in the 1940s (Cossíos 2010)[28].

1.109. Rainbow trout adapted well to the bioecological conditions of the high Andean zones' aquatic environments, characterized by the presence of lotic and lentic environments where rainbow trout is born and where it can migrate to feed and reproduce. Also, high primary productivity (production of organic matter carried out by autotrophic organisms through photosynthesis or chemosynthesis) and good physicochemical water conditions such as temperatures between 8°C to 18°C and the availability of dissolved oxygen in these areas meet the requirements of rainbow trout (PRODUCE 2015). Since species were unable to develop due to their sensitivity to water conditions and management and given the fast development of trout farming in the Andean highlands, beginning in the 1940s, the Peruvian government has focused on developing rainbow trout at the national level. It is now considered a naturalized species in the country, as autonomous populations have been established in habitats where they were previously exotic (Cossíos 2010).

[28] MINAM (20015). EXPLORACIÓN DE LA DISTRIBUCIÓN DE LA TRUCHA NATURALIZADA EN ZONAS PRIORIZADAS DE JUNÍN Y HÚANUCO. https://bioseguridad.minam.gob.pe/wp-content/uploads/2018/07/ldb_trucha_juninhuanuco_15.pdf

1.110. In the Puno region, around 30,000 tons of trout were farmed in 2013, increasing production by 36% from 2012 to 2013 and representing 83% of this specie's farming at the national level, followed by Junin. In 2014, the activity contributed 0.5% to Gross Value Added. Small-scale companies support the expansion of farming activities in Puno (from 2 to 50 tons), followed by subsistence companies (less than 2 tons), and only three larger-scale exporting companies.

1.111. The strong growth in rainbow trout production has become an opportunity to export embryonated eggs. Genetically improved trout (from imported eggs) have been shown to perform better than domestic trout. As a result, most domestic production is based on imported trout. According to PRODUCE (2018), regarding the origin of embryonated trout eggs in 2016, 52% came from the United States, 30% from Spain, 10% from Denmark, 7% from Great Britain, and 1% from Chile.

1.112. It is important to note the contribution of trout farming in terms of food and nutritional security. Aquaculture include staple foods in the food pyramid, and it has been shown that eating fish is more nutritious and healthy than eating a piece of meat. Over the years, consumers, in addition to consuming a healthy product, also seek to know its origin and its.

1.113. In 2020, the main species harvested in Peru was trout (37.7%). Other farmed species include scallops (33.1%), prawns (24.5%), tilapia (2.2%), paco (1.5%), and others (1.1%). In the same year, Piura, Puno, and Tumbes were the regions with the highest levels of production, with more than 109,000 tons of aquaculture resources harvested between them. Specifically, production in Puno was 33,962 tons, in Junin, 2,845 tons, and in Huanuco, 646 tons (PRODUCE, 2021).

1.114. In 2020, foreign exchange earnings from aquaculture products decreased by 6.3% compared to 2019. In the same year, 35.3% of trout exports went to the United States, and 26.7% to Japan. Regarding domestic sales in Peru, trout was the highest-selling species during 2020, with a share of 86.6%, followed by paco at 4.4% and tilapia at 3.7% (PRODUCE, 2020).

1.115. Between 2011 and 2020, rainbow trout farming in Peru grew by 171%, increasing from 19,962 tons in 2011 to 54,188 tons in 2020. Most of this production came from the Department of Puno, specifically from Lake Titicaca. Lake Titicaca is the second largest lake in South America with an approximate surface area of 8,400 km^2, located at an altitude of 3,810m above sea level, and considered the highest navigable lake in the world. The water quality of the lake and its basin is favorable for aquaculture, particularly rainbow trout farming.

1.116. In Puno, trout farming is undergoing gradual changes, such as the adoption of new production techniques, the use of imported eggs, the use of high-yield extruded feeds, and the use of modern structures. In 2006, the Puno Region became the first trout producer in Peru, reaching a production of 3,400 MT in specimens of three units per kilogram. Since it is the head of a river basin, Puno has more than 300 lagoons, many rivers, and numerous springs, all suitable for aquaculture in all its forms and production stages, contributing to the country's tremendous potential for industrial trout farming.

1.117. According to PRODUCE (2020), there are more than 2,800 productive units for trout, 45% of which engage in limited resource aquaculture (AREL), 54% participate in small and medium enterprises (AMYPE) and less than 1% in medium and large aquaculture enterprises (AMYGE).

1.118. Increasing or decreasing temperatures create habitat changes that influence the overall metabolism of trout, thus reducing growth and total predicted production.

1.119. The department of Junin ranks second in national trout production, with 2,119 thousand tons per year, according to reports from the Junin Regional Government (2017). Puno surpasses Junin by 5.5%. In the department of Junin, the largest trout producers are in the Yauli basin, La Oroya (37), the Mantaro valley (17), and Alto Cunas, Chupaca (12).

1.120. The rainbow trout's natural habitat in the areas visited includes rivers, lakes, and lagoons with cold, clean, and crystalline waters. It prefers moderate currents and generally occupies the middle sections of stony bottoms with moderate vegetation. Rainbow trout are cold-water fish. Although they tolerate a wide range of temperatures, they can subsist for several days at 25°C and almost freezing temperatures[29]. However, to achieve the desired fat level, the temperature should fluctuate between 11 to 16 °C, as lower temperatures extend growth time, while higher temperatures carry a higher risk of spreading diseases.

1.121. The biological development of trout comprises five stages: 1) Ova: after an average of approximately 30 days of incubation, fertilized eggs hatch into larvae; 2) Fry: small fish measuring from 3 to 10 cm and weighing between 1.5 gr. and 20 gr; 3) Juvenile. These are fish measuring between 10 and 15 cm, weighing between 20 and 100 gr. 4) Fattening. These measure between 15 and 22 cm and weigh between 100 and 200 gr. This

[29] https://bioseguridad.minam.gob.pe/wp-content/uploads/2017/02/INFORME-FINAL-MINAM-Trucha-2015.pdf

stage refers to obtaining gametes; 5) Commercial. This is the special stage where the fish have completed the fattening process before being sold. They measure 15-22 cm and weigh 100-200 gr.

1.122. There are three types of trout farming:

- **Extensive**: Planting or replanting in a body of water, feeding is based on the natural productivity of the environment, and there may be some conditioning.

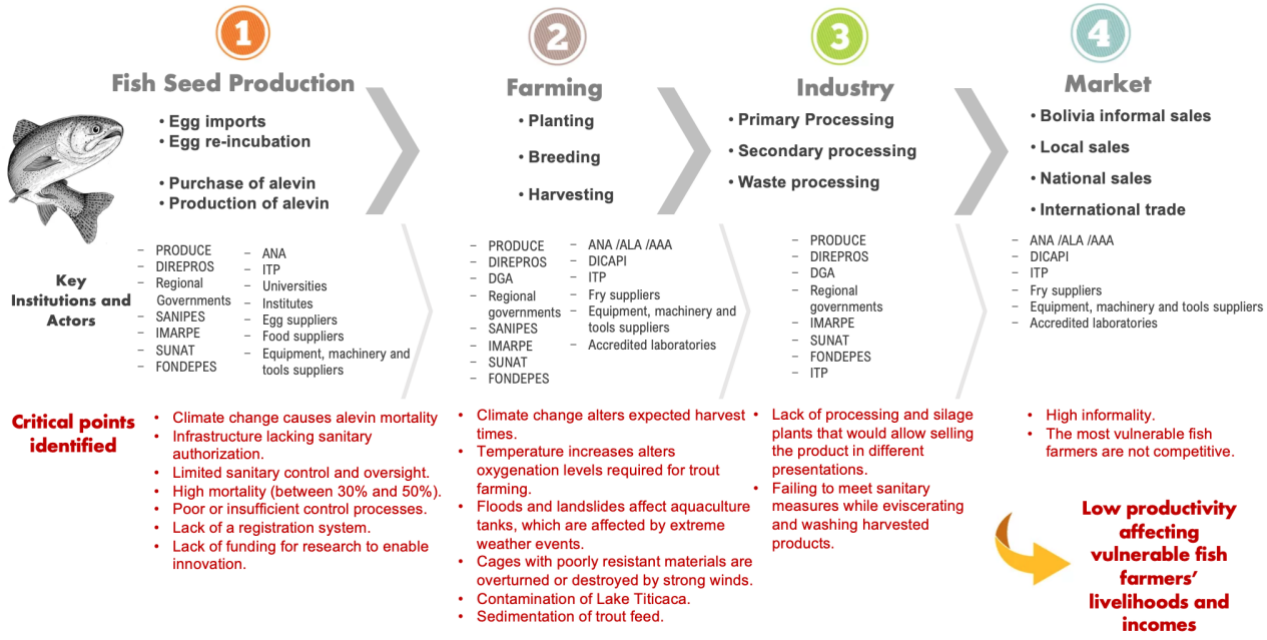
- **Semi-intensive**: Farming in natural or artificial environments, supplementary feed is used in addition to natural feed, and there is a more intensive intervention to manage and condition the environment.

- **Intensive**: Includes advanced technology and a more intensive intervention to manage and condition the environment to obtain high yields per unit area.

C.2.1. Aquaculture sector's value chain for trout farming in Peru

1.123. Based on the National Aquaculture Development Plan 2010-2021, the aquaculture value chain in Peru includes four linked elements: laboratory, field, industry, and market. Each link comprises activities or stages as described in the following figure:

Figure 13. Value chain of trout aquaculture production



Source: Prepared by the author based on "*Estudio Prospectivo de la Cadena de Valor de la Trucha*"[30] ("Prospective Study of the Trout Value Chain", PRODUCE, 2020).

1.124. Links or phases in the trout value chain and critical points identified in "*Estudio Prospectivo N°1 de la Cadena de Valor de la Trucha* (PRODUCE, 2020):

a- **FISH SEED PRODUCTION:** The rainbow trout production chain begins by obtaining the seed, i.e., 3-7 cm embryonated eggs and fry. Rainbow trout farming in Peru is currently supported mainly by imports of embryonated eggs, maintaining an import growth rate of 19% per year (Mendoza 2011). Imported eggs have a high mortality rate and although domestic eggs do not have the expected yield or adequate genetic characteristics, they are regaining interest for use as a production input. However, it is important to note that although local fry is more resistant, it is less productive than the former. A frequent difficulty in the production of local seed is the high levels of egg mortality in hatcheries and fish farms, probably due to difficulties in handling and the presence of pathogens. However, the increase in trout farming will require improving and promoting the production of local seed, which would lower production costs, avoid import procedures and make the product more readily available. Embryonated eggs entering the country are transported to hatcheries equipped with open-flow water circulation systems, which allow them to

[30] This study is available at https://www.pnipa.gob.pe/wp-content/uploads/2020/10/Estudio-de-prospectiva-PNIPA-Cadena-de-Valor-de-la-Trucha.pdf

hatch, obtain larvae and, finally, produce fry. The limitations of the hatcheries are related to the high dependence on embryonated eggs from abroad, which determines the supply and the inevitable risk of importing pathogens into production centers. Therefore, there is an urgent need to consider the production of quality domestic eggs. This initiative would improve the control of the value chain, both in terms of supply and prices, and more importantly, sanitary control over this production link. Temperature is a variable that affects the production of fry, a stage that requires temperatures between 9 to 12°C. Water warming negatively affects fry development and this limits the possibilities of trout reproduction and growth, a species that lives in low-temperature waters, requiring temperatures between 12 and 18°C for the fattening process.

b. **FARMING**: Production processes in this production link begin with the hatching of fry (alevin stage), followed by the juvenile stage and ending with the adult or fattening stage. In Peru, trout farming is carried out extensively, semi-intensively and intensively, working with a single species of trout (rainbow trout). Cultures are distributed in two production systems: the floating cage system and the pond system. The former is developed in lakes, lagoons, and dams, and is the most widely used due to the large availability of water bodies authorized by PRODUCE for aquaculture. The second is developed with water from springs, filtration, rivers and lakes (FAO, 2014).

The force of the wind causes waves to overtake the floating cages and even overturn or destroy them if they are not made of strong, high-quality materials. This causes the trout to escape or suffocate to death in the net. Additionally, the waves hit the boats, which can be stranded or even destroyed in a strong swell. In the fry stage, insufficient feeding regimes were identified, with greater emphasis on the floating cage system, where in general, only the calculated amount of food is distributed in a single dose per day, leading to underfeeding of the fish.

It also became evident that producers have limitations in ensuring that the parameters of the culture water (availability of oxygen in the water, temperature, hydrogen potential (pH), salinity, among others) are monitored daily, thereby gaining information on the quality of the water and identifying any deviation that could have serious effects on the fish.

At this stage, fluctuations in water temperature can affect the optimal aquatic conditions for trout farming and increase the costs of maintaining the temperature within rearing conditions. Climate change impacts and alters environmental factors, thus influencing the welfare of rainbow trout and leading to problems in growth rates. Thermal tolerance of rainbow trout depends on genotype, age, developmental stage, physical condition, and history of previous thermal exposure. Extreme changes and frequent fluctuations in water temperature will affect fish's endocrine, antioxidant, molecular, immune, and haemato-biochemical functions.

c. **INDUSTRY**: Products that will be exported and sold in some domestic markets are eviscerated and cleaned and stored in a cold chain in a licensed primary or industrial processing plant with sanitary authorization. However, except for products for supermarkets, poor aquaculture practices were identified in the processing of products destined for national and local markets and sent informally to Bolivia (only for producers in the department of Puno). The products were eviscerated and washed in farming centers or in environments that do not comply with sanitary regulations, without ensuring that processing takes place under hygienic and sanitary conditions, in closed environments, with clean water, ensuring the adequate disposal of waste and effluents generated and avoiding ice for refrigeration, i.e., to avoid contamination, physical damage and deterioration of trout quality.

Three factors are responsible for this deficiency: i) the lack of artisanal fish processing plants or primary and industrial processing plants strategically located close to the production areas; ii) producers' unwillingness to pay for gutting, washing and storage services in a processing plant; and iii) sanitary and aquaculture authority's weak enforcement of obligations and prohibitions established in regulations. These factors fail to attract private investment for the construction and implementation of processing plants.

d. **MARKET**: Rainbow trout are mainly sold in the local or national market and, to a lesser extent, indirectly to the international market through export companies. In the national market, trout are mainly sold whole, gutted, and, to a lesser extent, filleted. It can be fresh or frozen, usually loose (unwrapped or unpackaged), and to a lesser extent vacuum-packed. An essential element in this part of the chain is producers' or collectors' lack of compliance with sanitary regulations and health concerns during trout transportation to ensure its quality and safety.

Trout are mainly sold whole since there aren't enough refrigeration systems, and post-harvest processing activities are uncommon. Therefore, there is insufficient capacity to offer aquaculture products with added value in the form of gutted, chilled, or frozen fillets, smoked or canned trout, or in the form of nuggets, hamburgers, etc. Nonetheless, some state and private entities have developed isolated and small-scale initiatives in this direction.

1.125. **Cross-cutting findings and critical points throughout the value chain:**

a- Different activities along the value chain are highly informal. For example, there culture ponds that lack authorization, there are no rooms for the re-incubation of embryonated eggs, among other issues, including problems in concessions for the implementation of floating cages in Lake Titicaca, the transfer of the administrative right of concessions or authorizations for aquaculture, and required distances between concessions and bathymetry in Lake Titicaca, as established in the current Aquaculture Law.

b- Fish farmers lack the knowledge required to report the activities carried out and the yield obtained. They also engage personnel without a work contract, even though this is established in the regulations. These issues will be addressed by proposing sustainable solutions that enable fish farmers to gain more control and strengthen their tools and capacities to face adversities.

c- Trout production activities are often carried out empirically rather than based on technical knowledge. This is due to the lack of permanent availability of professionals, specialists and/or technicians to direct, plan and coordinate the different activities along the chain, such as managing available resources, developing optimal strategies and procedures, and quality assurance.

d- Activities are carried out without the health authority's authorization, such as the sanitary authorization of the aquaculture infrastructure that certifies compliance with design, construction, and equipment requirements; the sanitary certification ensures that aquaculture products are fit for human consumption; and the sanitary registration.

C.2.2. Climatic conditions affecting the vulnerability of trout farming

1.126. The alteration and loss of hydrobiological resources due to changes in climatic patterns will affect rainbow trout farming and, therefore, Peruvians' food security.

1.127. A study by Nature Communications (2020) analyzed time-series data (1970–2014) for 31 lakes across five continents and concluded that fish catches can respond either positively or negatively to climate and land-use changes. This study found that effects of a climate or land-use driver (e.g., air temperature) on lake environment could be relatively consistent in directions, but consequential changes in a lake-environmental factor (e.g., water temperature) could result in either increases or decreases in fish catch in a specific lake.

A subsequent correlation analysis indicates that reductions in fish catch were less likely to occur in response to potential climate and land-use changes if a lake is located in a region with greater access to clean water. This finding suggests that adequate investments in water-quality protection and water-use efficiency can provide additional benefits to lake fisheries and food security.

Environmental changes driven by climate and land-use changes have been linked to major shifts in fish catches (CATCHs) and species composition in many lakes around the world. Reduced lake CATCHs caused by climate and land-use changes can threaten food security and livelihoods of millions of people worldwide, especially in impoverished countries where rural poor communities may not have appropriate alternative sources of animal protein and employment opportunity (Kao, Yu-Chun, 2020[31]).

1.128. The most crucial challenge for aquaculture concerns the environmental and social sustainability of the farmed species. The future of farming must be based on progressively bio-secure systems that produce healthy, better-growing animals, ensure uniform harvests in terms of quantity and quality and minimal risk to ensure the lowest possible use of chemical antibiotics and generate the least negative environmental impact. It is also critical to consider policies to mitigate this activity's social and environmental impact (biological, organic, and chemical pollution, habitat modification, and changes in communities' production patterns).

1.129. Another important aspect is the need to develop mechanisms to improve yields, link production with other industries, and promote technologies such as selected seeds, polycultures, new foods, crop rotation, and microorganisms to purify water, etc. This involves new proven and revolutionary farming methods, such as intensive closed-cycle farming, fully controlled environments, cage farming, domesticated lines, probiotics, yeasts, and bacteria in feed, and the incorporation of new species to diversify production and supply.

[31] Author of “Effects of climate and land-use changes on fish catches across lakes at a global scale”. NATURE COMMUNICATIONS www.nature.com/naturecommunications

1.130. Trout are most susceptible to disease and high mortality in the early stages, i.e., the fry stage. The most common pathogens include the Yersinia ruckeri bacteria (Flores, 2013). This is a *Gram-negative* bacterium that belongs to the *Enterobacteriaceae* family. It mainly affects salmonids, and the most susceptible species is trout. Additionally, it causes high mortality rates, above 50% in many countries and leads to significant economic losses in fish farms (Flores, 2013). Several antibiotics have been used to control *yersiniosis*, such as oxytetracycline, sulfadiazine in combination with trimethoprim, florfenicol, oxolinic acid, flumequine and amoxicillin (Flores, 2013; Kumar et al., 2015). Given the limited spectrum of antibiotics approved for use in aquaculture, fish have generated resistance to these drugs (Pandiyan et al., 2013).

On the other hand, no commercial vaccines are available in Peru, making it more challenging to control this agent (Fernandez, 2011; Bueno, 2012). However, Cueva et al. (2016) developed an experimental vaccine in Peru, made with *Yersinia ruckeri* isolates, which has had promising in vitro results. In this context, there are other viable alternatives, such as probiotics; since a diet enriched with probiotic microorganisms improves fish's immune system, nutrient assimilation and normal development, it helps prevent bacterial infections (Walter, 2012; Berdasco, 2016). Moreover, beneficial bacteria extracted from the digestive tract of fish are more easily able to colonize the host's digestive tract (Henríquez, 2013; Muñoz, 2015).

Several studies note that using probiotics has an antagonistic effect against Yersinia ruckeri and other bacteria that affect trout farming, such as *Lactobacillus spp, Lactococcus spp, and Bacillus spp*[32]. Studies on the bacterial microflora of rainbow trout or those with beneficial potential against pathogenic bacteria are scarce in Peru.

1.131. **Water temperature is critical because it regulates trout growth, as trout cannot regulate their body temperature**. If the temperature is too low, growth is slow, at higher temperatures growth is faster. It is important to consider that temperature increases caused by climate change have led to decreased water oxygen levels, which are critical for aquaculture.

Figure 14. Required water conditions for trout farming

Parámetro	Rango	Óptimo
Oxígeno (ppm)	7,5 a 12	8,5
Temperatura (°C)	13 a 18	15
pH	6,5 a 8,5	7

1.132. According to the 2013 Aquaculture Census, artificial ponds, natural ponds, and artisanal floating cages are the most widely used technologies in aquaculture. Artisanal floating cages are used for extensive farming and semi-intensive trout farming in lakes such as the Titicaca in Puno. Artificial and natural ponds are also used for trout farming and farming prawns and tilapia, among other, less commonly extracted species.

1.133. A trout culture pond is a closed enclosure that serves as an artificial habitat capable of satisfying the animal's biological requirements in its natural environment. The fish farmer is responsible for responding to the nutritional needs and sanitary protection of fish to obtain favorable results in the expected production levels.

Concrete ponds are mostly built in an orderly manner, forming ponds of various dimensions based on the size of the trout, according to their stage or quantity. The proper conditioning of these ponds will facilitate the operational work and the efficient use of the rearing environments.

The stone masonry pond is another type of pond. It is built with local materials, usually boulders found in rivers.

Figure 15. Types of ponds for trout culture

Estanque rectangular

Estanque circulares

Estanques rectangulares

[32]Balcázar et al., 2009; Burbank et al., 2012, Palíková et al., 2015

1.134. Trout farming can also be carried out in floating cages installed in lagoons, reservoirs or dams, generally consisting of a floating platform that holds a submerged mesh "bag" or "cage", where the fish are kept in for specific periods.

1.135. Regarding the material used to build the floating cages installed in Lake Titicaca in the Puno region, more than 56.29% is handmade with eucalyptus sticks. Some 29.57% are semi-craft cages, built with metal tubes (Autoridad Binacional del Lago Titicaca/Binational Authority of Lake Titicaca, 2021). The following link provides access to a short video (0:19 seconds) showing the conditions of some of the cages in the Puno region, evidencing that they are built with precarious materials that make it difficult to resist the strong winds that occur in the area: https://www.youtube.com/watch?v=dz6A2pF1o1A

Figure 16. Artisanal floating cages for trout farming


1.136. For increased resiliency, floating cages should be of industrial quality, made from galvanized steel or HDP, with passageways that allow people's access to biomass handling, and with a 10-ton capacity.

Figure 17. Example of industrial cages for aquaculture (Source: AKVA, Group)


1.137. For trout farming, it is essential to consider the volume of water required in the initial infrastructure and to project future expansion plans. In this sense, ensuring the maximum flow of water in the dry season is necessary. Water should enter through the main rearing channel, thereby allowing the calculation of the top annual production of commercial trout. A constant flow of water will be needed to keep the production unit ponds full; therefore, it is necessary to carry out daily renewals to ensure year-long sustainable production.

1.138. Unfortunately, most micro and small-scale fish farmers (AMYPE) - and those with limited resources (AREL) - work in **very precarious conditions, without adequate formalization, with very little access to available technologies and little articulation in the value chains.** According to PRODUCE (2018), for aquaculture to be sustainable and competitive it is critical to address several dimensions, ranging from technological and commercial issues, logistical organization and access to credit, professionals and technicians, and a network of easily accessible service and goods providers. It also requires environmental regulations and those pertaining to the formal exercise of the activity.

1.139. Low-income fish farmers have difficulty accessing technologies that enable them to adapt to climate change risks. Despite training campaigns[33] on good environmental, safety and health practices, it has yet to be possible to train aquaculture workers living in remote areas, so there are still knowledge gaps regarding the climate change risks and impacts and necessary adaptation measures.

1.140. There are two main challenges that climate change poses for the aquaculture sector: i) the impact on aquaculture activities due to the loss of ecosystems caused by extreme climate events, and ii) the vulnerability of producers who work informally and have not been able to access funding. First, extreme weather events, aggravated by climate change, are causing the physical affectation of the ecosystems the aquaculture sector depends on, which alters the availability and productivity of hydrobiological resources destined for these activities.

[33] Some entities have focused on capacity building for the aquaculture sector. It is important to note that FONDEPES' functions include providing support. Some GOREs have also provided training. On the other hand, PNIPA has developed several innovation courses in aquaculture extension and circular economy. UNDP has provided training in spore farming techniques for coastal GOREs.

C.2.3. Analysis of the ecological and socio-economic vulnerability of trout aquaculture in the departments of Puno, Junin and Huanuco under IPCC concepts.

1.141. PRODUCE (2016) designed the climate change adaptation measures that are part of Peru's Thematic Fisheries and Aquaculture Area of the Nationally Determined Contributions (NDC). For this purpose, it used a conceptual model based on the analysis of human vulnerability and its implications on the productivity of fishermen, ship owners and fish farmers and its impact on their livelihoods. This model considers a socio-ecological approach to understand how marine and inland water systems could react to climatic and non-climatic pressures and their interrelationship with socio-economic systems.

1.142. PRODUCE'S General Directorate of Fisheries and Aquaculture Environmental Affairs is currently seeking to apply tools to strengthen the ecological and socio-economic vulnerability analysis of trout aquaculture activities in the departments of Puno, Huanuco and Junin in the context of climate change. For this, it will use the IPCC conceptual model adapted to the socio-ecological vulnerability framework, which identifies climate risk's characteristic elements (hazards, exposure, and vulnerability), different ecological and socio-economic indicators based on research studies and PRODUCE management instruments.

1.143. **Exposure/hazard indicator:** As part of the climate risk characterization process, the observed and/or expected climate change impacts on inland aquaculture activity in each region were identified.

Figure 18. Observed and/or projected climate change impacts

Region	Changes in climate parameter	Effects / Impact
Puno	1. Increased surface temperature of inland waters	• Changes in oxygen levels in lentic resources for the trout species' developmental requirement • Fry mortality
	2. Changes in wind intensity	• Damage to aquaculture infrastructure, mainly in cages.
Huanuco	1. Changes in rainfall	• Conflicts over water use • Risk of floods, landslides and mudslides affecting aquaculture infrastructure.
	2. Increased surface temperature of inland waters	• Changes in oxygen levels in lentic resources for the trout species' development requirements. • Fry mortality
Junin	1. Reduction of aquifers	• Water availability

1.144. **Sensitivity variables:** The IPCC defines sensitivity as the degree to which a system or species is positively or negatively affected by climate variability or change. In this sense, PRODUCE defined the variables "tons harvested", "number of jobs generated", and "poverty level" as the main variables to be impacted by changes in climate parameters and which would be related to the increased vulnerability of fish farmers and the livelihoods of families located in the regions of Huanuco, Junin and Puno, Peru.

a) **Poverty level**: The poverty analysis is based on information from INEI poverty reports to determine the percentage of the population classified as **Poor, Extremely Poor or Not Poor**, in relation to the cost of a basic basket of food and services. Information from PRODUCE's *Vulnerability Diagnosis* is used as a reference[34].

Assessment according to poverty level: The poverty line is the monetary equivalent of the cost of a basic consumption basket encompassing food and other items, which in 2014 corresponded to S/. 303 soles per month (USD 89.64). In 2020, it was equivalent to S/. 360 soles per month per inhabitant (USD 93.99). The extreme poverty line considers the population with a per capita expenditure that does not cover the basic food consumption basket cost, which in 2022 was estimated at 191 soles per person per month (USD 49.86)[35].

Vulnerability values were assigned on a scale of 5 to 3 according to the INE poverty categories, with extreme poverty being the most vulnerable. It should be noted that the "Not poor" category has a value of 3 because the poverty line estimated by INEI represents a low-cost basic basket of food and services, S/. 303 soles per month (USD 79.11) per capita in 2014, which does not ensure a low or very low vulnerability to the possible effects of climate change (PRODUCE, 2016).

Furthermore, according to additional information provided by the Ministry of Production's General Office of Impact Evaluation and Economic Studies (OGEIEE), poverty in 2021 dropped to 5% of fish farmers

[34] https://www.produce.gob.pe/index.php/dgsp/publicaciones/diagnostico-del-sector-pesquero-y-acuicola
[35] Exchange rate: 3.83 soles/USD (SUNAT, 2022). Retrieved on 16.11.2022 en https://e-consulta.sunat.gob.pe/cl-at-ittipcam/tcS01Alias)

at the national level and 15% received incomes below the Minimum Living Wage, which is equivalent to 930 soles (USD 242.82) (PRODUCE, 2022)., 2022).

Figure 19. Poverty Level as a Sensitivity Variable

Poverty category	Vulnerability condition	Description	Value (V)
Extremely poor	Very high	Monthly expenses are less than S/. 191 soles (USD 49.95) per person to cover the basic basket of food consumption	5
Poor, not-extremely	High	Monthly expenses are less than S/. 360 soles (USD 93.99) per person to cover the basic basket of food consumption	4
Not poor	Middle	Monthly expenses are greater than S/. 360 soles (USD 93.99) per person to cover the basic basket of food consumption	3

b) **Harvest level**: The regional harvest level is assessed. For the purposes of the study, landings have been divided into 3 categories according to the type of activity. For the regional assessment, a simple average of the last available years was used to eliminate yearly fluctuations; and the vulnerability classification includes 5 categories or ranges, weighting the regions with the highest landings at the most vulnerable regional level (PRODUCE, 2016). According to the Statistical Yearbook, the annual average (in tons) of trout aquaculture harvest is considered for the three regions.

Figure 20. Sensitivity Variables

Variable	Sensitivity to the impact of climate variability and climate change			
	Low	Medium	High	Very high
Annual tons harvested	From 257 to 30,984 tons	From 30,985 to 61,710 tons	From 61,711 to 92,437 tons	From 92,438 to 11,938 tons
Poverty levels		Not poor	Poor, not extremely	Extremely poor

1.145. **Socio-economic adaptive capacity:**

a. Technology: The technology variable reflects the population's adaptation or resilience to the potential effects of climate change. Therefore, in the case of aquaculture, the variable reflects the type of culture used, either extensive (with very little human intervention; it is used in restocking programmes in lagoons, reservoirs or dams for recreational use or to benefit a community), semi-intensive (animals are confined in large structures, such as cages or ponds, where planting density, artificial feeding, water replacement and water aeration are managed) or intensive (highly controlled production system with high initial costs, technology-intensive and high production efficiency, tendency to become independent of the site's climate and water quality and use of artificial farming systems).

b. Regional Climate Change Strategy (ERCC): According to the Organic Law of Regional Governments (Law 27867), each regional government must "formulate, coordinate, lead and supervise the implementation of regional strategies on biodiversity and climate change". In this sense, a variable is used to reflect the existence of the ERCC and its level of specificity in relation to the fishing activity.

Project Objectives:

1.146. The project's objective is to reduce aquaculture's vulnerability to climate change and climate variability, as this of the principal means of livelihood of communities in the regions of Huanuco, Junin and Puno, Peru, by implementing innovation mechanisms and technologies, strengthening capacities and the governance system, as well as increasing market competitiveness.

1.147. The project will increase aquaculture's adaptive capacity and reduce its vulnerability to climate change while taking advantage of opportunities to strengthen aquaculture productivity, the use of hydrobiological resources and food security. Without funding from the Adaptation Fund, vulnerable aquaculture-dependent households

are unlikely to achieve resilient development and strengthen their adaptive capacity. This would further deteriorate their economic situation and exacerbate food insecurity and the vulnerability of the aquaculture system.

Project Components and Financing:

1. Component 1: Governance, knowledge management and access to finance for sustainable and climate change-resilient aquaculture are strengthened.

2. Component 2: Improved management and development of climate change-resilient aquaculture.

3. Component 3: Strengthening the aquaculture value chain.

Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
		Component 1 Total (16% of direct costs)	**US$ 720,000**
Component 1: Governance, knowledge management and access to finance for sustainable and climate change resilient aquaculture are strengthened.	**1.1. Three (3) Institutional Strengthening Programmes**, one for each Regional Government of Huanuco, Junin and Puno. Estimated cost of US$ 15,000 per programme. **1.2.** Five (5) **policy instruments** are strengthened and/or developed to improve governance in the context of climate change. **1.3.** Three (3) **Resilient Aquaculture Training Centers** are established, one for each Huanuco, Junin and Puno. Each center has an estimated cost of US$ 180,000, which includes: Specific programmes for resilient aquaculture farmers; communities of practice; procedures to monitor egg importation; instruments to monitor water quality; workshops to increase access to funding; as well as the development of assessments and proposals for the improvement of aquaculture management. **1.4.** At least two collaboration agreements are developed between universities that can potentially provide research and knowledge support, and aquaculture producers that will implement technological improvements and strengthen the resilience of infrastructures.	**Outcome 1.1.1** The aquaculture sector's institutional capacities and governance instruments are strengthened in the context of climate change	**1.1** US$ 45,000 **1.2** US$ 120,000 **1.3** US$ 540,000 **1.4** US$ 15,000
		Component 2 Total (65% of direct costs)	**US$ 2,888,580**
Component 2: Innovation and technology transfer mechanisms are improved and/or implemented to promote resilient aquaculture activity in Huanuco, Junin and Puno, Peru.	**2.1** Three (3) Early Warning Systems (SAT) for extreme events for the aquaculture sector are designed and implemented, one for each of the prioritized regions Huanuco, Junin and Puno. **2.2** Three (3) Contingency Plans are developed for extreme climate change events. One for each region of Huanuco, Junin and Puno, including training and demonstrations, with a unit cost of USD 75,000. **2.3** An Integrated Statistical Information System that benefits all regions is designed.	**Outcome 2.1.1.** The aquaculture community's response capacity to extreme climate events is improved.	**2.1** US$ 550,000 **2.2** US$ 225,000 **2.3** US$ 40,000

Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
	2.4 Infrastructure will be built and/or improved in areas highly vulnerable to climate change. Also, technologies to help adapt production systems to climate change will be promoted. Specifically, the following will be implemented 2.4.1. **Water recirculation systems**, together with a solar panel. The estimated unit cost is US$ 12,000, including design, adaptation, installation and maintenance for 2 years. 15 systems will be delivered in Huanuco, 24 in Junin and 38 in Puno. **Subtotal US$ 924,000**. 2.4.2 **Probiotics**, including research and testing, for 15 fish farmers in Huanuco; 24 in Junin and 38 in Puno, at a unit cost of US$ 3,000. **Subtotal US$ 231,000.** 2.4.3. **Microbubble aerators**, together with a solar panel. The estimated unit cost is US$ 3,000, including design, adaptation, installation and maintenance for 2 years. 14 aerators will be delivered in Huanuco and 6 in Junin. **Subtotal US$ 60,000.** 2.4.4. **Biofloc systems.** These will be combined with microbubble aerators. The estimated unit cost is US$ 6,500, including design, adaptation, installation and maintenance for 2 years). 7 Biofloc systems will be delivered in Huanuco and 3 in Junin. **Subtotal US$ 65,000.** 2.4.5. **Oxygenator**s. 14 will be delivered in Huanuco; 24 in Junin and 38 in Puno, with a unit cost of US$ 4,500, including design, adaptation, installation and maintenance for 2 years. **Subtotal US$ 342,000.** 2.4.6. **Climate resistant cages**. 3 cages will be installed in Huanuco and 38 in Puno, at a unit cost of US$ 4,500. **Subtotal US$ 184,500.** 2.4.7. **One (1) offshore Cage** for the Resilient Aquaculture Training Center in Puno, at an estimated cost of **US$ 5,000.** 2.4.8. **Water harvesting and reforestation projects.** One in each region of Huanuco, Junin and Puno. **Sub-total US$ 175,500.** 2.4.9. **Technologies and tools for good environmental management. US$ 86,580.**	**Outcome 2.1.2. Climate change adaptation infrastructure and technologies enable the sustainable use of hydrobiological resources for aquaculture.**	**2.4** US$ 2,073,580
		Component 3 total (19% of direct costs)	**US$ 855,000**
Component 3: Strengthening the value and production chains of resilient aquaculture activities will help diversify aquaculture producers' livelihoods	**3.1** Production chain facilities will be upgraded. Three (3) primary processing plants will be built with a silage area to improve the final product presentation (one for each region, Huanuco, Junin and Puno). **3.2** Development and implementation of marketing strategies for aquaculture products for each of the primary processing plants.	**Outcome 3.1.** The aquaculture sector's value chains are strengthened, and climate related losses are reduced.	**3.1** US$ 675,000 **3.2** US$ 60,000

Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
and improve their food security.	**3.3** At least two (2) Business Plans for aquaculture farmers are developed in Huanuco, Junin and Puno, for a total of six (6) Business Plans that address projects to develop economic activities that can be complemented with rainbow trout farming. Each Business Plan is estimated at US$ 20,000.	**Outcome 3.2** Aquaculture producers diversify their economic activity.	**3.3** US$ 120,000
6. Project Execution cost (**direct costs**) *			**US$ 424,040**
7. Total Project Cost (direct costs + project execution cost) (A)			**US$ 4,887,620**
8. Project Cycle Management Fee charged by the Implementing Entity (estimated 8,4%). (B)			**US$ 410,560**
Amount of Financing Requested (A+B)			**US$ 5,298,180**

1.148 ***Note:** Project Execution Cost refers to indirect costs, which will include::

- Salaries of one (1) General Coordinator, (1) Administrative Assistant and (1) Environmental and Social Specialist.
- Annual environmental and social management monitoring plans.
- Annual external audits.
- Mid-term report.
- Project Closure Report.
- Systematization of results and lessons learned document.
- Tools such as videos and infographics to share and disseminate the project:
- Travel and per diem Lima - Huanuco - Junin - Puno.
- Administrative and bank expenses.

A detailed assessment of the full proposal's indirect cost items will enable identifying the costs that would be assumed with the implementation fee.

Interinstitutional coordination

1.149 In Peru, PRODUCE is the national governing body for aquaculture. It carries out functions in the General Directorate of Aquaculture (*Dirección General de Acuicultura, DGA*), the National Aquaculture Commission (*Comisión Nacional de Acuicultura*, CNA), the National Fisheries Development Fund (*Fondo Nacional de Desarrollo Pesquero*, FONDEPES), the Peruvian Marine Institute (*Instituto del Mar del Perú*, IMARPE), the National Fisheries Health Agency (*Organismo Nacional de Sanidad Pesquera*, SANIPES), and the Technological Institute of Production (*Instituto Tecnológico de la Producción*, ITP).

1.150 The Regional Directorates of Production (*Direcciones Regionales de la Producción*, DIREPROS) share duties with PRODUCE in the areas of micro and small enterprise aquaculture (AMYPE) and limited resource aquaculture (AREL). The DIREPROS are part of the Regional Governments (Huanuco, Junin and Puno).

1.151 The project will be technically implemented by PRODUCE'S the General Directorate for Environmental, Fisheries and Aquaculture Affairs (DGAAMPA), which will lead technical committees for the implementation of each project component. These committees will include at least one official from the institutions that are part of the National Aquaculture System. These Technical Committees will coordinate with the Project Team, which is described in Part III, pages 57-58, of this Concept Note.

1.152 The project will be implemented by CAF - Development Bank of Latin America, in its role as an accredited agency to the Adaptation Fund. CAF will be responsible for assessing the fiduciary capacity of various entities that present themselves with the profile for the administrative implementation of the project.

1.153 The Ministry of the Environment is the Peruvian focal point for the Adaptation Fund.

1.154 A Steering Advisory Committee for the project will include the following members:

- Two (2) representatives from the General Directorate of Climate Change and Desertification of the Ministry of Environment MINAM.
- Two (2) representatives of PRODUCE'S Fisheries and Aquaculture Vice-Minister's Office.
- Regional Production Directors DIREPROS, from Huanuco, Junin and Puno.
- Regional Environmental Authorities representatives.
- Two (2) CAF - Development Bank of Latin America representatives.
- Representatives of the Administrative Executing Agency (to be defined).

1.155 The Advisory Steering Committee will coordinate the implementation of activities and ensure the results of each project component are achieved. It will work with technical and scientific bodies and/or sector entities, thus providing recommendations to the Technical Executing Agency - PRODUCE.

1.156 Officials from the National Aquaculture System (*Sistema Nacional Acuícola*, SINACUI) institutions will be invited to the project's Advisory Steering Committee periodic meetings, even if they are not formally part of this committee, to obtain feedback and recommendations on the project's progress.

1.157 Work will be coordinated with the National Service of State Protected Natural Areas (*Servicio Nacional de Areas Naturales Protegidas por el Estado*, SERNANP) and the Regional Conservation Areas (*Áreas de Conservación Regional*, ACR) when the project intervenes or impacts these areas.

1.158 Training in water resources management (component 1) will be coordinated with the National Water Authority (*Autoridad Nacional del Agua*, ANA).

1.159 On issues of river safety, integrated water management and lake zoning for aquaculture activities, the General Coastguard Directorate of the Ministry of Defense (*Dirección General de Capitanías y Guardacostas del Ministerio de Defensa*, DICAPI), the Peruvian Amazon Research Institute (*Instituto de Investigaciones de la Amazonía Peruana*, IIAP), the Special Binational Lake Titicaca Project (*Proyecto Especial Binacional Lago Titicaca*, PEBLT), among others, will be involved.

1.160 Meetings will be held with the main universities in the regions of Huanuco, Junin and Puno, as well as institutes and research centers, such as the Centers for Productive Innovation and Technology Transfer (*Centros de Innovación Productiva y Transferencia Tecnológica*, CITE). In Puno, Universidad Nacional del Altiplano (UNA), which offers degrees such as Biology, Agro-industrial Engineering, Chemical Engineering, among others. In Huanuco, the *Universidad Nacional Agraria de la Selva* (UNAS) and the *Universidad Nacional Hermilio Valdizan* (UNHEVAL). These offer degrees in Food Industry Engineering and Animal Husbandry, among others. In Junin, the most representative is the *Universidad Nacional del Centro del Perú*.

1.161 NGOs dedicated to promoting the sustainability of aquaculture producers, such as WWF Peru, among others, will be contacted.

1.162 The Regional Governments (GORE) are also actively involved in the project, as their powers are to monitor, promote and strengthen governance.

1.163 This Concept Note was prepared by a team formed by PRODUCE'S DGAAMPA, MINAM'S General Directorate of Climate Change and Desertification (MINAM) and CAF'S Climate Change Coordination. Additionally, the design of the project concept was supported by the consultancy firm Factor, which has coordinated several meetings with key aquaculture and climate change actors in Peru since 2021. Below are the details of some of these meetings:

Date of meeting	**Participants**	**Highlights**
1. August 10, 2021	• MINAM • PRODUCE	- Participants agreed on a delivery date for the first draft of the Concept Note and a list of stakeholders.
2. September 07, 2021	• PNIPA	- PNIPA works on three main axes: Innovation in aquaculture, Innovation in fisheries and governance.
3. September 07, 2021	• FONDEPES	- As a technology, a water recirculation system powered by renewable energy could be an alternative for temperature control. - Aquaponics: implementation requires capacity building. - There is no early warning system.
4. September 08, 2021	• *Universidad Científica*	- Degrees such as aquaculture engineering or biology could include a certification in aquaculture related to technologies for resilience to climate change. - Establish measures to increase effective responses to extreme climate events, thereby improving the opportunity to access credit or insurance coverage from private financial institutions.
5. September 08 2021	• *Universidad Nacional José Faustino Sanchez Carrión*	- Participants suggested implementing water recirculation systems, lowering the load of nitrogen compounds and favoring oxygen intake. - Participants mentioned using Biofloc as an input for feeding the bacteria produced in the crops, which in turn will serve as fish feed. - The high cost of balanced feed was addressed. - Participants raised the feasibility of building water planting projects or water reservoirs (*gochas*) for aquaculture.
6. September 09, 2021	• *Instituto del Mar del Perú – IMARPE*	- A strategy was set forth to increase the visibility of technical advice as a capacity-building option. - The need to update the legal framework to differentiate between aquaculture and fisheries was mentioned. - It is necessary to promote the creation of spaces for dialogue.

Date of meeting	Participants	Highlights
		- Resume alliances, agreements and understandings between the parties.
7. September 24, 2021	• WWF Perú • Regional government-DIREPRO Puno • DIREPRO Huanuco	- WWF presented the objective of designing climate change strategies. - DIREPRO Puno mentioned that there is no official document that includes data on the impacts of climate change. - Factor suggested that reforestation is a measure to consider when addressing temperature fluctuations.
8. July 11, 2022	• DIREPRO Junin. • PRODUCE. • MINAM.	- PRODUCE and MINAM presented the project proposal. - DIREPRO provided feedback and validated the proposal, and the areas of intervention were prioritized.
9. July 13, 2022	• DIREPRO Huanuco • PRODUCE. • MINAM.	- PRODUCE and MINAM presented the project proposal. - DIREPRO provided feedback and validated the proposal, and the areas of intervention were prioritized.
10. July 15, 2022	• DIREPRO Puno • PRODUCE. • MINAM.	- PRODUCE and MINAM presented the project proposal. - DIREPRO provided feedback and validated the proposal, and the areas of intervention were prioritized.
11. July 18, 2022	• DIREPRO Junin. • PRODUCE. • MINAM. • aquaculture producers.	- PRODUCE presented the project proposal. - Fish farmers showed interest in participating in the project, provided feedback and validated the proposal. - The gender approach was incorporated.
12. July 20, 2022	• DIREPRO Huanuco. • PRODUCE. • MINAM. • Aquaculture producers.	- PRODUCE presented the project proposal. - Fish farmers showed interest in participating in the project. - The gender approach was incorporated.
13. July 22, 2022	• DIREPRO Puno. • Instituto del Mar del Perú. • SANIPES. • PRODUCE. • MINAM. • Aquaculture producers.	- PRODUCE presented the project proposal. - The group of fish farmers showed interest in participating in the project, giving feedback, and validating the proposal. - The gender approach was included to make women's empowerment and participation in the project visible.

1.164 Although there are national programmes in the aquaculture sector, it is still necessary to strengthen regional governments' capacities to develop an aquaculture agenda with a climate change approach. Therefore, the Organic Law of Regional Governments, Law No. 2786727 establishes the formulation of climate change strategies. At the sectoral level, the Multiannual Sectoral Strategic Plan 2017-2021 prioritizes vulnerable regions for industrial fishing, artisanal fishing and aquaculture.[36]

Projected Calendar:

Milestones	Expected Dates
Start of Project Implementation	April, 2024
Mid-term Review (if planned)	April, 2026
Project/Programme Closing	April, 2028
Terminal Evaluation	October, 2028

[36] BID. (2019). Avances del Perú en la adaptación al cambio climático del sector pesquero y del ecosistema marino-costero.https://publications.iadb.org/publications/spanish/document/Avances_del_Per%C3%BA_en_la_adaptaci%C3%B3n_al_cambio_clim%C3%A1tico_del_sector_pesquero_y_del_ecosistema_marino-costero_es_es.pdf

PART II: PROJECT JUSTIFICATION

A. Describe the project components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience.

1.165 In Peru, innovation drives development by increasing productivity, enhancing competitiveness, and energizing the economy while increasing millions of people's income and quality of life. These benefits can be seen in fishing and aquaculture, a sector with enormous tradition and potential in the country. Considering the impact of climate change on aquaculture, this project sets forth a solution for rainbow trout farming productivity, which is highly sensitive to the effects of climate and supports the livelihood of many families in Peru.

1.166 The project aims to strengthen the resilience of trout farming aquaculture activities in the regions of Huanuco, Junin and Puno. These regions were prioritized based on their climate vulnerability, socioeconomic conditions, and contribution to the national aquaculture sector, as well as their budgetary constraints in adopting technologies to reduce climate change exposure and strengthen value chains to increase their competitiveness.

1.167 The project primarily focuses on technological innovation to strengthen aquaculture's resilience, which supports many families' livelihoods. Implementing innovative mechanisms and technologies in aquaculture activities will help improve the sector's governance system and production chains, thereby strengthening aquaculture financial mechanisms. As a result, this will help reduce vulnerability and increase the aquaculture sector's capacity to adapt to climate change. It will also increase productivity and the use of farmed species, facilitating access to financing for aquaculture farmers.

1.168 The project will promote sector development based on climate change-resilient technologies and infrastructure. The project will enable beneficiaries to learn and engage in knowledge generation and dissemination activities, which will help catalyze the sector's resilience and adaptive capacity. The project will also create an enabling environment for implementing innovative technologies and infrastructure, such as creating regulatory frameworks and policies in line with Peru's climate change adaptation strategies and plans.

1.169 Projected future climate threats could increase negative impacts on the economy and fish farmers' livelihoods and production. This project introduces innovations in the traditional scenario of aquaculture in the regions of Huanuco, Junin, and Puno, promoting sustainable aquaculture growth while taking advantage of their extensive marine, mountain and Amazonian ecosystems.

1.170 The project will focus on limited-resource fish farmers (AREL) and small and medium-sized trout farmers (AMYPE), as they are the most vulnerable to the impacts of climate change.

1.171 A climate change risk analysis was carried out for the aquaculture sector in rainbow trout farming. This analysis is based on an assessment of Peru's climate context and threats, specifically in the regions of Huanuco, Junin and Puno, and an analysis of these regions' main socioeconomic factors. In aquaculture, the elements exposed to the impacts of climate change include aquaculture workers, aquaculture production and infrastructure, and food security. This characterization led to the identification of different adaptation measures included in the project "Implementing protection technologies to foster the resilience of aquaculture in the regions of Huanuco, Junin, and Puno to strengthen food security in the context of extreme events associated with climate change". The table below provides a summary and description of these measures.

Climate hazards	Potential impacts	Exposure	Sensitivity	Adaptive capacity[37]
• Floods, mudslides and alluviums	• Alteration of water quality due to increased sedimentation. • Loss of hydrobiological resources. • Impact on food security due to loss of hydrobiological resources. • Impact on the transportation and distribution of hydrobiological products. • Reduced profits and increase in insurance premiums. • Loss of employment.	-Aquaculture workers -Aquaculture production -Aquaculture infrastructure -Food safety	-Sensitivity of aquaculture hydrobiological resources to climatic hazards -Diversification of aquaculture species -Granted aquaculture rights -Self-consumption (harvesting for self-consumption)	• Promote the institutional strengthening of aquaculture activities in Peru. • Ensure an appropriate regulatory framework for the promotion of climate change-resilient aquaculture. • Strengthen capacities to transfer climate change resilient technology in aquaculture activities. • Improve the connection between research generation and productive activities (practices). • Enhance access to financing to mitigate climate change risks for aquaculture. • Implement early warning systems for extreme events. • Implement contingency plans to prevent and respond to extreme weather events linked to climate change. • Implement adaptation technologies in the aquaculture sector. • Improve the facilities and infrastructure of production chains • Strengthen the value chain and support access to markets. • Diversify fish farmers' income-generating activities.
• Aridity conditions (droughts)	• Water shortage in aquaculture crops. • Altered behavior of farmed species. • Reduced productivity of target species. • Impact on food security due to loss of hydrobiological resources. • Loss of employment.			
• El Niño Phenomenon	• Altered behavior of farmed species. • Loss of hydrobiological resources. • Impact on food security due to loss of hydrobiological resources. • Loss of employment.			
• Glacial retreat	• Altered water quality due to increased sedimentation. • Loss of hydrobiological resources. • Reduced profitability and increased insurance premiums. • Loss of employment.			

1.172 **Component 1: Governance, knowledge management and access to finance for sustainable and climate change-resilient aquaculture are strengthened.**

1.173 **Outcome 1.1. The aquaculture sector's institutional capacities and governance instruments are strengthened in the context of climate change**

1.174 **Activity 1.1.1.** The project will carry out institutional strengthening processes in the Regional Governments (GORES) of Huanuco, Junin and Puno in favor of aquaculture. This activity will consider the aquaculture sector's political relevance in the GORES strategic planning processes. An **Institutional Strengthening Program** will be designed and implemented for each region (3 in total), aimed at GORES officials for the implementation of the proposed regulatory improvement actions proposed in Activity 1.1.2. This program will consist of different pedagogical and training tools such as workshops, webinars, guides, among others.

[37] Ministerio del Ambiente. (2021). Plan Nacional de Adaptación al Cambio Climático del Perú: un insumo para la actualización de la Estrategia Nacional ante el Cambio Climático Retrieved from: https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf

Beneficiaries of this activity will include public officials and representatives of the academic community, who will be better prepared in climate change issues, as well as 936 trout aquaculture farmers in Huanuco, Junin and Puno (AMYPE and AREL) and their families. In total, 3,744 people will benefit from stronger institutions that can manage aquaculture activity to make it more sustainable.

Likewise, two AMYGE category aquaculture producers in Puno will benefit (there are no AMYGE in Junin or Huanuco). The remaining aquaculture producers who farm other fish species will also benefit (these amount to 1,156 in Huanuco; 464 in Junin and 50 in Puno. If we consider their families, 6,688 beneficiaries depend on aquaculture to earn a living.

In total, this activity will benefit 10,432 individuals who depend on aquaculture activities and about 150 officials and representatives of the academic community.

1.175 **Activity 1.1.2.** This activity involves compiling existing regulations on aquaculture as input to drafting proposals for new legislation or adjusting existing legislation to promote climate-resilient and sustainable aquaculture management.

Furthermore, policy instruments will be developed to ensure women's equitable participation in aquaculture. Based on the consultative workshops that have been held so far in Huanuco, Junin and Puno, the following specific tasks were identified as necessary:

a. **Ensuring that current and future climate change risk management is considered in aquaculture evaluations**. Currently, the Peruvian Marine Institute (Instituto del Mar del Perú – IMARPE) is responsible for assessing areas for the delimitation of trout farming zones, which is a requirement that aquaculture farmers must comply with to obtain a permit. The evaluation processes should include a cross-cutting approach to climate risk management. It is worth noting that this will benefit not only trout farmers but also all those who farm species in the country's marine and continental areas.
b. **Carrying out an assessment and designing a regulatory proposal that limits the location (distance) of fish farms in the same water body in the upper and lower part of rivers**. Currently, there is no regulatory framework to regulate aquaculture activities in the upper parts of the basin, which benefit from water availability produced by rainfall in these areas. This situation could increase water deficit problems in lower areas and further deteriorate in the context of climate change.
c. **Zoning Lake Titicaca for the development of economic activities in the context of climate change**. Assess the progress of zoning activities in Lake Titicaca in the Puno region concerning fishing and aquaculture activities while considering climate change risks. Currently, aquaculture overlaps with other economic activities (fishing areas) and there is a risk that it can be affected by untreated effluents from domestic use that are discharged on the shores of the lake.
d. **Promoting good environmental practices**. Creating awareness and information instruments that lead to improved environmental management of aquaculture activities, with emphasis on managing effluents and sludge, as well as treatment and discharge infrastructure. Also, focusing on waste management and systems for evaluating and monitoring biological and chemical parameters that may affect aquaculture management, mainly in the AREL category.
e. **Developing a territorial basin approach for climate change adaptation as a governance model** in aquaculture to improve articulation, coordination and cooperation between key stakeholders in aquaculture and other economic activities in the area.

Beneficiaries of this activity include GORES officials, who will receive the regulations and tools for proper sustainable aquaculture management.

At the same time, 936 trout farmers from the regions of Huanuco, Junin and Puno (AMYPE and AREL), as well as their families, will benefit (3,744 in total).

Additionally, two aquaculture producers in the AMYGE category in Puno will benefit (there are no AMYGE in Junin or Huanuco). The remaining aquaculture producers who farm other fish species will also benefit (1,156 in Huanuco; 464 in Junin and 50 in Puno). If we consider their families, 6,688 beneficiaries depend on aquaculture to earn a living.

In total, this activity will benefit 10,432 individuals who depend on aquaculture activities.

1.176 **Activity 1.1.3.** Aquaculture producers' knowledge will be strengthened to support the transfer of climate change resilient technology through **Resilient Aquaculture Training Centers**. The following tasks will be carried out as part of this activity:

a. **Identifying aquaculture producers' knowledge gaps** in areas such as technologies for adaptation in the aquaculture sector, sanitary quality and safety, marketing of aquaculture products and their added value, environmental management, occupational safety, and gender and circular economy in a context of climate change. A program will be created to address the identified gaps in knowledge.

b. Identifying existing training centers for the implementation of **Specific Programs for Resilient Fish Farmers.** The activity seeks to produce material and spaces for training and technical support for aquaculture farmers. This will include preparing agreements with the Regional Production Directorates and Regional Governments to guarantee the commitment and sustainability of these centers and programs.

c. Creating **Communities of Practice** to dynamize knowledge and share lessons learned. This will involve strengthening officials and technicians of the National Fisheries Development Fund - FONDEPES in cooperation with other sector entities, universities and aquaculture producers.

d. Designing and implementing P**rocedures to Monitor Egg Importation** with biosafety certificates. It is critical to estimate demand to plan the number of imported eggs and thus satisfy the existing demand in the local and national markets, while ensuring that the population continues with its commercial and productive activities. It is also necessary to certify the biosecurity of imported eggs because the lack of adequate control could lead to the appearance of viruses, bacteria and fungi, which would be difficult to control in the future.

e. Designing and applying **instruments to monitor water quality** (e.g., control of egg diseases in the upper basin-lower basin).

f. **Assessing and strengthening** the functional and operational capacities of the Regional Production Directorate of the Regional Government-DIREPRO to provide technical-legal assistance to fish farmers to implement climate change adaptation measures.

g. Planning and implementing a set of actions to **avoid and prevent future risks** caused by climate change in aquaculture projects.

h. Increased opportunities to access financing. The idea is to ensure that the Resilient Aquaculture Training Centers will provide fish farmers with the necessary skills to access competitive funds from the National Program for Innovation in Fisheries and Aquaculture-PNIPA. This program grants credits that the most vulnerable fish farmers in Huanuco, Junin and Puno have been unable to access.

Peru had the PNIPA was created in 2017 by PRODUCE as a public investment initiative to finance research and development projects. The program had a fund of approximately US$120 million, of which US$40 million came from a World Bank loan and US$80 million from Peruvian government resources. PNIPA promoted the creation of an innovation agenda and a network of aquaculture stakeholders; The program is closing and evaluating its possible continuation.

Aquaculture producers' capacities will be strengthened to formulate a project portfolio in line with requirements set by PNIPA and other sources, thereby increasing the likelihood that their loan applications will be approved, and they will be able to take advantage of existing financing mechanisms in Peru. Moreover, and due to the interest shown in the consultative processes, aquaculture farmers will receive information on other national or international financing sources, how to access them and how to prepare feasible and profitable business models that meet financiers' requirements (Canvas, Start Up, or others).

This activity will produce at least one project proposal for each region (Huanuco, Junin and Puno) to be submitted to the PNIPA or another climate finance source, or international cooperation (GIZ, CAF, IDB, etc.). Also, in the context of this activity, guides or manuals will be prepared offering guidance on preparing proposals and identifying funding opportunities, and capacity-building workshops will be offered.

Workshops will be held to provide training on access to financing, preparing proposals and business models.

Beneficiaries of this activity will include GORES officials and 936 trout aquaculture farmers in Huanuco, Junin and Puno (AMYPE and AREL) and their families, for a total of 3,744 direct beneficiaries.

1.177 **Activity 1.1.4.** The links between research and productive activities will be improved by developing **collaboration agreements between potential universities that can support research and knowledge generation** and aquaculture producers who will implement technological improvements and strengthen the resilience of infrastructures. Furthermore, this activity helps university students pursuing Biology or Aquaculture careers to do internships or practices in aquaculture production centers. At the same time, aquaculture farmers can obtain information from research conducted by universities.

Outputs of this activity include two collaboration agreements with national or regional universities, several training and knowledge exchange workshops (exact number to be defined), as well as funding for at least two research processes on innovation and climate resilience in aquaculture.

Beneficiaries of this activity will include GORES officials and 936 trout aquaculture farmers in Huanuco, Junin and Puno (AMYPE and AREL) and their families, for a total of 3,744 beneficiaries.

Additionally, two aquaculture producers in the AMYGE category in Puno will benefit (there are no AMYGE in Junin or Huanuco). The remaining aquaculture producers who farm other fish species will also benefit (1,156 in Huanuco; 464 in Junin and 50 in Puno). If we consider their families, there are 6,688 beneficiaries who depend on aquaculture to earn a living.

In total, this activity will benefit 10,432 individuals who depend on aquaculture activities. Additionally, this activity will benefit university students pursuing undergraduate and graduate degrees related to aquaculture activities.

1.178 **Component 2: Innovation and technology transfer mechanisms are improved and/or implemented to promote resilient aquaculture activity in Huanuco, Junin and Puno, Peru.**

1.179 **Outcome 2.1. The aquaculture community's response capacity to extreme climate events is improved.**

1.180 **Activity 2.1.1.** An early warning system (EWS) for extreme events in the aquaculture sector will be implemented for each Huanuco, Junin and Puno. This activity will consider implementing these EWSs to predict climatic conditions for aquaculture. The implementation of each EWS will include training and education for aquaculture farmers in the use of this type of technology.

Specifically, with the support of the National Meteorology and Hydrology Service (*Servicio Nacional de Meteorología e Hidrología*, SENAMHI), one EWS will be designed and implemented for each of the following locations:

- Huampo micro-basin, Ambo Province, in Huanuco.
- Chiapuquio micro-basin, Huancayo Province, in Ingenio, Junin.
- Lake Titicaca, in the department of Puno. In this case, besides working with SENAMHI, we will also work with the Peruvian Marine Institute (Instituto del Mar del Perú, IMARPE). Although there are currently several weather stations in Lake Titicaca, they do not measure variables such as temperature in the water column, oxygen line depth and wind speed, among other critical parameters for aquaculture.

It is worth noting that all EWS installed in the context of the project will cover variables that existing meteorological stations do not consider. They will also use specially adapted technologies to measure strategic parameters for aquaculture activity and climate variables that must be predicted and shared with aquaculture farmers to help them prepare for and prevent losses.

Beneficiaries of this activity will include GORES officials and 936 trout aquaculture farmers in Huanuco, Junin and Puno (AMYPE and AREL) and their families, for a total of 3,744 beneficiaries. Additionally, two aquaculture producers in the AMYGE category in Puno will benefit (there are no AMYGE in Junin or Huanuco). The remaining aquaculture producers who farm other fish species will also benefit (1,156 in Huanuco; 464 in Junin and 50 in Puno). If we consider their families, there are 6,688 beneficiaries who depend on aquaculture to earn a living.

In total, this activity will benefit 10,432 individuals who depend on aquaculture activities.

1.181 **Activity 2.1.2.** Contingency plans will be developed to support producers' response to extreme weather events related to climate change. This is an essential activity because Peru's aquaculture sector lacks a contingency plan for extreme weather-related events.

Specifically, with the support of the National Civil Defense Institute (INDECI) and in coordination with regional authorities, one contingency plan will be developed for each of the following locations:

- Huampo micro-basin, Ambo Province, in the department of Huanuco.
- Chiapuquio micro-basin, Huancayo Province, in the town of Ingenio, in Junin.
- Lake Titicaca, Department of Puno.

Aquaculture farmers will receive training on procedures and actions to respond to adverse weather events; these procedures will be included in the contingency plans, which will be complemented by installing EWSs specifically for the aquaculture sector.

Contingency plans will benefit 936 trout farmers in the regions of Huanuco, Junin and Puno (AMYPE and AREL), and their families, for a total of 3,744 beneficiaries.

Additionally, two aquaculture producers in the AMYGE category in Puno will benefit (there are no AMYGE in Junin or Huanuco). The remaining aquaculture producers who farm other fish species will also benefit (1,156 in Huanuco; 464 in Junin and 50 in Puno). If we consider their families, there will be 6,688 beneficiaries.

In total, this activity will benefit 10,432 individuals who depend on aquaculture activities.

1.182 **Activity 2.1.3.** Design and implementation of an **Integrated Statistical Information System** to generate, process and disseminate accurate and timely information on fishing and aquaculture productive and economic activities by using standardized methodological techniques.

In total, this activity will benefit 10,432 individuals who depend on aquaculture activities.

1.183 **Outcome 2.2. Climate change adaptation infrastructure and technologies enable the sustainable use of hydrobiological resources for aquaculture.**

The project will support the construction and/or improvement of infrastructure in areas highly vulnerable to climate change. Furthermore, the project will encourage AMYPE and AREL trout farmers to adopt technologies to adapt production systems to climate change. These trout farmers and their families work in very precarious conditions and this activity will help build and modernize aquaculture facilities to make them resilient to climate change.

Below is a detailed description of the improvements in infrastructure and technology the project will support for the resilience of aquaculture of AMYPE and AREL in Huanuco, Junin and Puno. The improvements and technologies described below have been validated by PRODUCE based on national and international experiences and were agreed upon with aquaculture farmers and other key stakeholders during the consultative workshops.

a) In Huanuco:

a.1. Water recirculation systems for ponds.
For aquaculture production, recirculation systems allow reusing water by applying physical, chemical and biological treatment, which enables using less than 10% of the water required in a conventional culture. This type of system provides a suitable environment to promote the growth of aquatic organisms and the efficient control of water's physical-chemical parameters. It is presented as a solution to reduce the environmental impact, enable better disease control and promote sustainable aquaculture.
In aquaculture, the physical-chemical parameters of water are fundamental elements of good practices. Furthermore, this type of system allows monitoring and controlling physical-chemical parameters such as temperature, salinity, dissolved oxygen, carbon dioxide, hydrogen potential (pH), alkalinity and metabolites such as ammoniacal nitrogen, nitrites, and nitrates.
One water recirculation system will be installed for 14 AMYPE aquaculture producers dedicated to trout farming in the areas most vulnerable to climate events. Furthermore, one system will be delivered to Huanaco's Resilient Aquaculture Training Center, where it will be used as a model for workshops and training activities, for a total of 15 systems. It is worth noting that each system will be installed with a solar panel to guarantee the energy required for its operation.
To compensate for the investment, water circulation systems must be installed in large areas with high fry planting density, which is characteristic of AMYPE, but not AREL fish farmers. Furthermore, these technologies require maintenance and the average income level of AMYPE farmers is not enough to allow for this.

a.2. Probiotics: Probiotics have been used in aquaculture for several years to stimulate fish's immune response (Nayak, 2010), establish a healthy environment in their gastrointestinal tract (Pandiyan et al.,

2013), significantly increase larval survival (Luis-Villaseñor et al., 2013), increase disease resistance through competition and immunomodulation, or increase appetite and improve feed conversion. Probiotics are involved in preventing and treating acute infectious digestive diseases and chronic intestinal and liver diseases. They act on host immune function and intestinal homeostasis, and can modulate the intestinal microbiota (Castañeda Guillot, 2018).

Vendrell et al. (2008) analyzed probiotic supplementation's effect on controlling lactococcosis in rainbow trout. Probiotics were administered orally for 30 days at a concentration of 107 CFU g of feed. Results showed that probiotic supplementation reduced fish mortality from 78% in the control group to 46-54% in the groups that received probiotics.

This activity will include the necessary research and tests to define the type and number of probiotics required by each fish farmer according to the particular characteristics of their crops. In this regard, probiotics will be delivered to 14 AMYPE in Huanuco and to the Resilient Aquaculture Training Center.

It should be noted that probiotics will not be delivered to AREL-category fish farmers, as they will benefit from Biofloc systems, which use microbial strains that act as probiotics.

a.3. Aerator: This mechanical equipment incorporates atmospheric oxygen into the water stored in the culture tanks. An aerator sucks air from the atmosphere and injects it as microbubbles into the water column, generating an efficient oxygen transfer. In turn, the aerator's propeller generates strong circulation, accelerates oxygen dissolution in the water, and creates optimal conditions for aquaculture. This technology will allow fish farmers to solve the problem of reduced oxygen levels caused by the increase in surface temperature caused by climate change, which causes trout mortality.

Peru has prior experiences with aerators, as PNIPA has carried out initiatives providing technical assistance services for adopting different types of aerators powered by solar panels.

It is estimated that aerators will be installed in 13 AREL in Huanuco. Moreover, one unit will be delivered to the Resilient Aquaculture Training Center in this region for a total of 14 microbubble aerators.

a.4. Biofloc systems: Biofloc systems are an efficient alternative to mitigate the negative impacts of aquaculture water discharges because they can continuously recycle and reuse nutrients by associating their aerobic microbial communities with the substantial organic matter in ponds. They maintain the system's carbon and nitrogen balance because they can remove these compounds from the water as bacterial biomass. These systems enable increasing crop density, expanding productivity per unit area, decreasing water use, and minimizing the use of space, thus reducing production costs. At the same time, Biofloc systems provide an increased quality product by managing high planting densities, which means more fish meat is obtained than in a traditional system.

Some examples of successful applications of the Biofloc system have been observed in countries such as South Korea, Indonesia, Malaysia, Thailand, China, Australia, Hawaii, Brazil, Ecuador, Peru, Colombia, USA, Mexico, Guatemala, and Belize (Emerenciano com per., 2011). In Mississippi, USA, the John Ogle Biosecurity System farm showed a 69.85% survival of cultured organisms, with a production of 15.4 to 17.5 tons/ha/cycle, at densities of 100-150 animals per m3 of Panaeus vannamei shrimp (Boone, 1931), with an approximate production cost of USD 2.4- 2.80/kg. The CreveTope farm in Shanghai, China, produced 25 tons per year of P. vannamei, without the need for water replacement.

Biofloc will first be delivered to fish farmers located in the upper part of the basin, since they transmit the contamination to those located in the lower part of the basin. This system will not be delivered in Puno because the Biofloc technology works only in ponds or enclosed spaces. In this sense, Biofloc systems are expected to be installed in six 6 ARELES in Huanuco, and one unit will be delivered to the Resilient Aquaculture Training Center in this region, for a total of seven Biofloc systems.

It is important to note that AMYPE category fish farmers will not receive Biofloc systems, as they will benefit from probiotics (see paragraph a.2. above).

a.5. Oxygenators: Temperature greatly impacts the oxygenation of fish and other animals. On the one hand, animals' metabolic rate increases (as long as the temperature increase is within the tolerance limits of the farmed species), and on the other hand, the solubility of oxygen in water decreases. In other words, oxygen demand is higher at high temperatures while available oxygen decreases. Oxygenators help to maintain a sufficient oxygen saturation level in water where aquaculture species are farmed. At a saturation level below 85%, feed utilization begins to drop, and the fish become vulnerable to disease

and eventually die; therefore, this equipment is essential for increasing growth and productivity in aquaculture.

PNIPA has co-financed studies on the use of oxygenators in aquaculture in Peru and these will be used as inputs for implementing this activity.

Oxygenators will be installed in 14 AMYPE in Huanuco.

a.6. Heavy-duty floating cage: This infrastructure is generally built using galvanized or HDPE material. It is resistant to strong winds caused by climate change and helps mitigate potential risks of raising limited trout specimens using unsuitable infrastructure. These cages cannot be overturned or destroyed, preventing trout from escaping or dying and avoiding impacts on other organisms.

The cages to be installed will be able to withstand waves up to 8 meters high and winds of up to 80 km/hour. They can be round or square, with nylon or polyethylene nets and HDPE structures. The project will rely on Puno fish farmers' experience in designing, constructing, and installing this floating cage. *Instituto Superior Tecnológico Público Juli*, which participated in an experience co-financed by PNIPA, will also contribute to these activities.

Two heavy-duty floating cages will be installed in Huanuco, and an additional unit will be delivered to the Resilient Aquaculture Training Center to be used as a tool for workshops and training, for a total of 13 resistant cages.

a.7. A water harvesting and reforestation project. A water harvesting or water reservoir (gocha) infrastructure to guarantee water availability. Water harvesting is being successfully implemented in several regions of Peru in response to climate change and water stress problems. Water harvesting improves the interception, storage, and regulation of rainwater in soil, subsoil, and aquifers for use during drought and dry periods.

Water harvesting will be combined with reforestation activities, which will contribute to reducing impacts from floods and mudslides, which can impact ponds, cause contamination and kill trout, and contribute to the accumulation of water in the subsoil. However, due to the characteristics of the intervention area at more than 3,700 meters above sea level, the project will identify the most suitable tree species with water regulation properties.

b) <u>In Junin</u>:

b.1. Water recirculation systems for ponds. This type of system will be installed for 23 AMYPE fish farmers dedicated to trout farming in areas highly vulnerable to climate events. Also, one system will be delivered to the Resilient Aquaculture Training Center in Junin to serve as a model for workshops and training activities, for a total of 24 water recirculation systems.

b.2. **Probiotics**: Probiotics will be delivered to 23 AMYPE in Junin, as well as to the Resilient Aquaculture Training Center.

b.3. **Microbubble aerator**: It is estimated that aerators will be installed in five AREL in Junin, in addition to one unit to the Resilient Aquaculture Training Center in this region, for a total of six microbubble aerators.

b.4. **Biofloc Systems**: Priority will be given to delivering the Biofloc to fish farmers in the upper part of the basin since they transmit contamination to those in the lower part of the basin. In this context, Biofloc systems will be installed in two AREL in Junin, in addition to a unit delivered to the Resilient Aquaculture Training Center in this region, for a total of three Biofloc systems.

b.5. **Oxygenators**: Oxygenators will be installed in 23 AREL in Junin, besides one oxygenator that will be delivered to the Resilient Aquaculture Training Center, for a total of 24 oxygenators.

b.6. **One (1) water harvesting and reforestation project**.

c) <u>In Puno</u>:

c.1. Water recirculation systems: One water recirculation system will be installed for 37 AMYPE aquaculture producers in highly vulnerable areas. Likewise, one system will be delivered to the Resilient Aquaculture Training Center in Puno to serve as a model for workshops and training activities, for a total of 38 water recirculation systems.

c.2. Probiotics: Probiotics will be delivered to 37 AMYPE in Puno, as well as to the Resilient Aquaculture Training Center.

c.3. Oxygenators: Oxygenators will be installed in 37 AREL in Puno and one oxygenator will be delivered to the Resilient Aquaculture Training Center, for a total of thirty-eight (38) oxygenators.

c.4. Heavy-duty floating cage: 37 heavy-duty floating cages will be installed in Puno and an additional unit will be delivered to the Resilient Aquaculture Training Center in this region to be used as a tool in workshops and trainings events, for a total of 38 heavy duty cages installed.

c.5. One offshore cage: This type of cage serves a similar function to heavy-duty floating cages, with the difference that they are submersible. In other countries, they have been used to reduce the stress of the species; therefore, Puno fish farmers suggested this alternative in one of the consultative workshops. However, the feasibility of using this type of technology in the region will be validated when the project proposal is completed.

c.6. Reforestation for water regulation and to cope with high temperatures.

d) Tools for good practices in environmental and occupational safety in Huanuco, Junin and Puno.

This component includes the environmental, social, gender, and occupational health and safety measures required to ensure that all beneficiary farmers comply with environmental and occupational health and safety regulations, as well as the Adaptation Fund's Environmental and Social and Gender Policy.

These measures should be established based on the results of a yet unfinished gap analysis involving the final beneficiaries. The measures should mainly address the following aspects: (i) Generation of trout farming effluents; (ii) Domestic effluents; (iii) Solid waste generation (including mortality); (iv) Fuel management; (v) Combustion gas emissions; (vi) Noise caused by equipment, motors and machinery; and (vii) Controls to prevent species escapes.

Based on the consultative workshops held so far, we can say that the following components will be necessary for some beneficiaries:

- **Biodigester**: 50 biodigesters are included (preliminary). The amount will be adjusted according to the identification of existing gaps. The biodigester is used for the primary treatment of sewage and gray water to be discharged into the soil (absorption or infiltration well) or drained. It uses an internal anaerobic filter that increases the efficiency of water treatment and does not require electricity for its operation or any chemicals to treat the water.
- **Effluent treatment plant**: 50 plants are included (preliminary). The amount will be adjusted according to the identification of existing gaps. The treatment system will depend on the specific aquaculture activity; it may include sedimentation pits, grease traps, and oxidation pits, among others.
- **Waste and chemical management components**: 50 components are included (preliminary). The amount will be adjusted according to the identification of existing gaps. This includes areas for waste and chemical product storage, treatment systems, and final waste disposal.
- **Technology:** Technology to control the escape of species: 50 items are included (preliminarily). This technology will help prevent trout species from escaping into the environment.
- **Implementation of safety equipment and controls in the workplace**: 50 pieces of equipment are included (preliminarily) to support occupational health and safety. These include: (i) safety signs; (ii) emergency response measures; (iii) personal protection equipment; and (iv) controls that will be determined based on the identification of hazards and risk assessment of specific activities.
- **Monitoring and follow-up systems**: Preliminarily, these include adapting or reinforcing five monitoring systems. They will be implemented mainly in sensitive areas where aquaculture is performed.

Although the measures described above were identified and agreed upon during the project's early concept development phase, other more cost-effective options may be shared with key stakeholders in upcoming consultative workshops where the full project proposal will be structured.

1.184 **Component 3: Strengthening the value and production chains of resilient aquaculture activities will help diversify aquaculture producers' livelihoods and improve their food security.**

1.185 **Outcome 3.1. The aquaculture sector's value chains are strengthened, and climate related losses are reduced.**

1.186 **Activity 3.1.1.** The facilities of the trout aquaculture sector's production chain will be improved. The infrastructure for trout collection, handling, primary processing, and product preservation systems will be modernized. Currently, fish farmers individually purchase products such as trout feed and packaging material, among others. There is evidence showing that promoting local associations between small producers helps them get better prices, incorporate technologies and have the capacity to expand their markets.

It has also been identified that fish farmers in Huanuco, Junin and Puno lack primary processing plants to prepare different trout presentations, which is sold whole (with viscera, head, etc.). Hence, promoting a circular economy would help increase fish farmers' competitiveness; selling trout in different presentations would also allow them to sell the remaining by-products (e.g., as biofertilizers).

To achieve this, Huanuco, Junin and Puno will each receive an equipped primary processing plant, which will include an area for trout waste by-products silage (e.g., balanced feed, fertilizer, etc.), to improve the final presentation of the product for sale. This involves building three plants on public land, purchasing equipment and implements for each plant, such as stainless-steel tables, a vacuum sealing machine, clothing for plant personnel, air conditioners and freezers among other implements.

The regional governments' DIREPRO will be responsible for supervising and controlling these plants, assuming the maintenance costs and utilities. There are ongoing discussions regarding the possibility that each consultant contributes a small percentage of their sales to help with maintenance costs.

This activity benefits 936 trout farmers in the regions of Huanuco, Junin and Puno (AMYPE and AREL), as well as their families, for a total of 3,744 beneficiaries. At the same time, this activity could provide job opportunities for approximately 20 people. Women heads of household will be prioritized for these job opportunities.

1.187 **Activity 3.1.2.** The value chain and market access of the production chain of trout aquaculture will be strengthened. This activity includes developing and implementing marketing strategies for aquaculture products generated in the processing plants, in an effort to increase competitiveness and create greater opportunities to enter the formal market.

1.188 **Result 3.2 Aquaculture producers diversify their economic activity by complementing it with activities and products related to trout production.**

1.189 **Activity 3.2.1. Income-generating** activities of 936 trout fish farmers in Huanuco, Junin and Puno (AMYPE and AREL) and their families will be diversified, for a total of 3,744 direct beneficiaries.

The project will develop a portfolio of projects and technological alternatives to diversify the livelihoods of aquaculture workers. We will seek to promote complementary activities to aquaculture, such as ecotourism or aquaponics.

- **Ecotourism**: Trout farming activity could be strengthened if combined with ecotourism and/or gastronomic tourism, taking advantage of the landscapes and cultural richness of the Huanuco, Junin, and Puno regions. The proposal is to offer tourists the opportunity to learn about the rainbow trout production process and the gastronomic culture of trout while enjoying the landscape and natural attractions. A gastronomic route could be offered as a tourist attraction and this would help maintain the landscape, disseminate local culture, foster economic development and better position the territory.
- **Aquaponics[38]:** The temperature range for rainbow trout farming is optimal for plants that thrive in cold temperature, such as green leafy plants, which include lettuce, beets, carrots and spinach, among others. Likewise, plants with high nutrient demands, such as tomatoes, cucumbers, peppers or others, as well as fruits, such as strawberries and herbs, such as basil, also represent a good option for combined farming with rainbow trout. However, water temperature is an important aspect to consider, as it significantly affects plant and fish growth. Experts have identified aquaponics as a promising strategy that can contribute to developing new forms of trout farming. Aquaponics can be integrated into rainbow trout farming, providing higher incomes for fish farmers and improving effluent quality. From an environmental point of view, aquaponics represents a new technology that improves production efficiency, while

[38] Vasdravanidis, Christos, Maria V. Alvanou, Athanasios Lattos, Dimitrios K. Papadopoulos, Ioanna Chatzigeorgiou, Maria Ravani, Georgios Liantas, Ioannis Georgoulis, Konstantinos Feidantsis, Georgios K. Ntinas, and Ioannis A. Giantsis. 2022. "*Aquaponics as a Promising Strategy to Mitigate Impacts of Climate Change on Rainbow Trout Culture*" https://www.mdpi.com/2076-2615/12/19/2523

mitigating environmental impacts, diversifying fish production, increasing animal welfare in aquaculture systems, among other benefits.

This activity's output includes developing at least two business plans for aquaculture farmers in Huanuco, Junin and Puno, for a total of six business plans addressing economic projects that can complement rainbow trout farming, taking into account feasibility conditions and opportunities to generate higher incomes and take advantage of these region's the scenic beauty and cultural attractions.

Project beneficiaries

1.190 The project will directly benefit 936 vulnerable fish farmers in the regions of Huanuco, Junin and Puno (AMYPE and AREL) and their families (each fish farmer is responsible for four dependents or family members on average), for a total of 3,744 direct beneficiaries. Beneficiaries will be able to access financing sources and their regional authorities will have the necessary regulatory and policy instruments to promote resilience to climate change in rainbow trout aquaculture. They will also benefit from academic research findings on how to strengthen climate change resilience and will learn how to engage in other trout farming activities to increase their income and become more resilient.

1.191 The most vulnerable direct beneficiaries will receive technological tools to strengthen the aquaculture infrastructure. Due to budget constraints, only a small number of beneficiaries will benefit from technological tools and solutions as described in Project Output 2.2. Community assemblies will be held to define which AMYPE or AREL aquaculture farmers will benefit, giving priority to the following farmers: 1) Women heads of household; 2.) Their household food expenses are below the minimum living wage, which will be corroborated using the 2021 National Household Survey; and 3.) They are registered as natural persons, which will have priority over those registered as legal persons. All assemblies held to select beneficiaries will include minutes and supporting information. Also, beneficiaries will sign certificates of delivery and binding agreements to guarantee the proper use of the goods received and to certify they have complied with the requirements to qualify for these benefits.

1.192 Women heads of household be prioritized to receive technologies to strengthen their aquaculture infrastructures and they will also be prioritized to hold jobs in the primary processing and silage plants.

1.193 Furthermore, the Regional Directorates of PRODUCE belonging to the Regional Governments of Huanuco, Junin and Puno will benefit, as their officials will be better trained and will have robust policy and regulatory instruments for properly managing aquaculture activities in the context of climate change.

1.194 The number of indirect beneficiaries of the project would be 6,688 fish farmers and families, comprised of 2 aquaculture producers in the AMYGE category located in Puno (there are no AMYGE in Junin or Huanuco); as well as the rest of the fish farmers that farm other fish species in the intervention regions: 1,156 in Huanuco; 464 in Junin; and 50 in Puno.

1.195 Children in the regions are another group of indirect beneficiaries, since they would have increased access to rainbow trout, a highly nutritious food.

1 Describe how the project provides economic, social, and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations.

1.196 **Additional environmental benefits**: The project will enable the most vulnerable fish farmers AMYPE and AREL to sustainably manage aquaculture hydrobiological resources through good health, safety and environmental practices, and guidelines and campaigns for consuming seasonal hydrobiological resources. AREL, which comprise low-income fish farmers, will significantly improve their environmental practices.

Additionally, water quality and the conservation of the aquaculture ecosystem will be improved through technologies for the management, treatment and discharge of effluent, sludge and undigested feed produced in aquaculture operations.

1.197 **Additional social benefits:** The project will strengthen the food security and livelihoods of the aquaculture community by improving this sector's adaptive capacity and resilience to extreme climate change events.

Women will be provided with trout, which is traditionally presented as a nutritious food for their children's diet, especially younger children.

Fish farmers will strengthen their technological capabilities in aquaculture activities through training and education activities in good health, safety, and environmental practices and in adaptive capacity to climate

change. In addition, governance will be strengthened with protocols, guidelines, and plans for climate change-resilient aquaculture.

1.198 **Additional economic benefits:** Aquaculture productivity and the use of hydrobiological resources will be improved. This will result in economic benefits such as reduced losses due to climate change impacts, the financial sector's increased confidence to invest in the aquaculture sector, and reduced production costs. These characteristics translate into a strengthening of the sector's competitiveness.

With the cost reduction and the added value provided by the project, the sector becomes attractive for more people to become involved in the activity. In addition, fishery certifications integrate economic benefits that include environmental costs and promote diversification of the aquaculture sector. The implementation of the project will limit economic losses in production, infrastructure, livelihoods, services, ecosystems, and environmental resources in the aquaculture sector due to extreme weather events associated with climate change.

1.199 **Gender Approach**: It is important for the project to help improve the quality of detailed information on women's participation in aquaculture by including a gender approach in the technical and regulatory instruments and technologies for climate change adaptation that will be developed.

Women's participation in aquaculture organizations and the assemblies held in the project's context will be encouraged. Likewise, priority will be given to women heads of household when selecting beneficiaries.

Planned training events will include gender issues to encourage women's engagement in activities and jobs throughout the aquaculture value chain. This will help strengthen women's self-esteem and capabilities.

2 Describe or provide an analysis of the cost-effectiveness of the proposed project

1.200 The project is a comprehensive strategy to strengthen the resilience of rainbow trout aquaculture and the prioritization of adaptation measures for each component seeks to address each phase of the trout farming value chain. Therefore, the project aims to strengthen the capacities of the institutions involved, support the design and update of climate change public policy instruments and regulations and resiliency strengthening strategies, promote technological solutions to strengthen aquaculture infrastructure and increase the competitiveness of the market's most vulnerable fish farmers.

1.201 Besides benefiting rainbow trout farmers and their families in the regions of Huanuco, Junin and Puno, this project's comprehensive approach and adaptation measures will also benefit other farmers in these regions, thereby expanding the project's impact on resilience.

1.202 The project recognizes the importance of strengthening participating public institutions. Therefore, it considers personnel training and aims to build a solid foundation in terms of policy instruments, regulations, and procedures.

1.203 In the universe of fish farmers, several of the proposed activities will benefit trout farmers and their families - including small or medium-sized producers- and families that farm other fish species.

1.204 Besides strengthening trout aquaculture's resilience to the impacts of climate change, the project will significantly impact the nutrition of thousands of Peruvian children. Promoting the inclusion of trout in school feeding policies and programs will improve children's nutritional status and adoption of healthy eating habits in a context of environmental responsibility, in line with FAO guidelines to promote healthier diets based on inclusive and sustainable food systems.

1.205 The availability of nutritious and safe food is essential to ensure people's proper nutrition, or in other words, its food security. In this regard, the Ministry of Development and Social Inclusion (MIDIS) conducted an assessment of food security in Peru, considering food availability, access, utilization, and stability. In this context, the consumption of rainbow trout is recommended for developing children and athletes due to its high protein value, which strengthens and accelerates muscle growth and tissue regeneration.

1.206 Additionally, aquaculture has the lowest carbon footprint of all food production sectors, which means it can provide high nutritional quality food with minimal greenhouse gas emissions. The technological solutions proposed with the project have been planned with the use of clean energy from photovoltaic panels.

3. Describe how the project is consistent with national or sub-national sustainable development strategies, including, where appropriate, national adaptation plan (NAP), national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

1.207 The project is aligned with the following policy instruments, plans and strategies:

a. **Peru's Nationally Determined Contribution (NDC) Multisectoral Working Group Final Report**[39]**.** This is the framework for addressing climate change in Peru. The Government of Peru has designed adaptation measures in five thematic areas to address the risks associated with extreme climate change events. These measures address fishing and aquaculture as priority areas, encompassing 18 measures, six of which correspond to aquaculture.

b. **Updated report on Nationally Determined Contributions for 2021-2030,** which commits to contributing to the global adaptation goal by reducing damages, possible alterations, and current and future losses. It also highlights taking advantage of the opportunities offered by climate change to pursue sustainable and resilient development in five thematic areas: i) Agriculture; ii) Forests; iii) Fisheries and aquaculture; iv) Health; and v) Water[40].

c. **Framework Law on Climate Change**[41] **(Law No. 30754),** especially Article 15, which specifies that the three government levels will work jointly and in coordination to adopt climate change adaptation measures that guide the implementation of the Paris Agreement NDC specified in the previous point. The following adaptation measures have been prioritized in the aquaculture sector[42]:

- **Strengthening aquaculture management** in the context of climate change. The aim is to ensure that information and management tools for aquaculture investment and intensification consider opportunities and risks associated with climate change. These instruments refer mainly to the generation of demand information, statistics, employment, and replication of business plans, development of strategies and procedures for granting rights.
- **Capacity building in good health and safety practices in aquaculture**: The purpose of this program is to strengthen the capacity of fish farmers to adopt good health practices (hygiene, sanitation, safety, and waste management) to ensure the sanitary quality and safety of aquaculture products in the event of rain, floods, droughts and abnormal waves.
- **Capacity building in good environmental practices**: The purpose is to reduce anthropogenic pressure and increase the adaptive capacity of aquaculture systems to cope with climate change impacts. These good practices refer mainly to managing effluents and sludge using adequate infrastructure for treatment and discharge; managing waste from undigested feed and decomposing organic matter; controlling application of chemical products; and systems for evaluating and monitoring biological and chemical parameters that may affect the ecosystem's resiliency.
- **Managing current and future climate change risks in the assessment of areas for aquaculture**: The purpose of this program is to ensure that the evaluation, determination and selection of viable areas for aquaculture activities include an assessment of climate change risks for water resources and aquatic environments. This will help prevent aquaculture infrastructure from being exposed or vulnerable to climate change hazards.
- **Capacity building in the design and implementation of contingency plans for preventing and responding to extreme climate events**: The purpose of this program is to implement actions to use and manage information on climate hazards and vulnerabilities; capacity building in relation to early warning systems; and the formulation and implementation of contingency plans, protocols, alerts, and responses.
- **Implementation of technological knowledge for the aquaculture species production chain in the context of climate change**: The purpose of this program is to apply technological knowledge, such as increasing food efficiency, alternatives to the use of fishmeal and fish oil, aquaculture of native herbivorous species and regulatory incentives.

d. **The National Climate Change Strategy (ENCC)** is the main management instrument that guides the State's long-term actions on climate change and contributes to the implementation of the NDCs.

[39] https://www.minam.gob.pe/cambioclimatico/wp-content/uploads/sites/127/2018/12/Informe-final-GTM-NDC_v17dic18.pdf

[40] In the case of Huanuco, there are various experiences that have contributed to increasing surface water retention capacity and aquifer recharge. The regional government has implemented reforestation and pasture repopulation in the headwaters of the watershed; however, it is necessary to include climate change adaptive and risk management measures. Likewise, the Regional Climate Change Strategy for the "Ecosystems and Biological Diversity" sector has identified the improvement of conservation, recovery and sustainable use of wetland ecosystems (wetlands, lagoons, etc.) in aquifer recharge areas and headwaters, contributing to increased resilience in the context of climate change.

[41] Framework Law on Climate Change https://www2.congreso.gob.pe/Sicr/TraDocEstProc/Expvirt_2011.nsf/Repexpvirt?OpenForm&Db=201600270&View

[42] https://cdn.www.gob.pe/uploads/document/file/571780/Cat%C3%A1logo%20MACC-NDC%202021.pdf.pdf

e. **Supreme Decree number 164-2021**[43] defines the establishes the pillars of the Government's General Policy for 2021-2026, including some related to aquaculture activities, such as i) Promoting welfare and social protection through food security; ii) Economic reactivation and productive activities based on agricultural and rural development; iii) Promotion of science, technology, and innovation.

f. **National Adaptation Plan**[44] **(NAP).** According to the NAP, the central problem of the fisheries and aquaculture sector is related to the productivity and use of hydrobiological resources for fishing and aquaculture activities in the context of climate change. The NAP also highlights the increased vulnerability of families participating in fishing and aquaculture activities in the context of climate change and the latter's impact on the productivity of these activities.

   Specifically, the project is aligned with the following Specific Priority Objectives (SPO) of the National Adaptation Plan:

   - **SPO 1:** "**Reducing possible damage, alterations and consequent current and future losses on individuals and their livelihoods as a result of climate change hazards**". Regarding aquaculture, the aim is to strengthen the opportunities offered by climate change by improving the capacity of individuals engaged in aquaculture to implement good intensive aquaculture practices that consider climate change risks and opportunities and include the health, safety, and quality of aquaculture products as key factors for food security. Furthermore, implementing good aquaculture practices will strengthen risk management in evaluating aquaculture areas in the context of climate change. It will also support an aquaculture insurance system for extreme climate events and technologies to increase the productivity of aquaculture activities in a climate change scenario.
   - **SPO 3: "Reducing possible damage, alterations and consequent current and future losses on individuals and their livelihoods as a result of climate change hazards**". It is essential to reduce the exposure of those involved in aquaculture to potential extreme weather events that could harm safety and productivity.

g. Additionally, the project will contribute to the following measures defined in the NAP:
   - Strengthening aquaculture management in the context of climate change (PAC13).
   - Capacity building in good aquaculture health and safety practices (PAC14).
   - Capacity building in good environmental practices to address climate change hazards (PAC 15).
   - Management of current and future climate change risks in the evaluation of aquaculture areas (PAC16).
   - Capacity building in designing and implementing contingency plans to prevent and respond to extreme weather events associated with climate change in aquaculture (PAC17).
   - Supporting knowledge transfer and application across the aquaculture production chain in the context of climate change hazards (PAC18).

h. **Supreme Decree No. 002-2017 from the** Ministry of Production - PRODUCE, approves PRODUCE'S new Organization and Functions Regulations. It became effective on February 2, 2017, and includes the creation of DGAAMPA, which comprises the directorates of Climate Change and Fisheries and Aquaculture Biodiversity (DCCBPA) and Environmental Management (DIGAM). DCCBPA functions include formulating, proposing, and promoting the implementation of programs, projects, and actions to support climate change adaptation and reduce greenhouse gas emissions from fishing and aquaculture activities. It also includes new provisions for monitoring, evaluating, and governing NDCs.

i. **Innovation system** implemented by the Ministry of Production and the National Program for Innovation in Fisheries and Aquaculture, comprising the PNIPA[45] and the National Aquaculture Development Plan (2010-2021) [46]. PNIPA-financed projects are undoubtedly a point of reference for technological solutions pilot tests.

[43] Supreme Decree N164-2021: https://conadisperu.gob.pe/observatorio/wp-content/uploads/2021/11/DECRETO-SUPREMO-N%C2%B0-164-2021-PCM.pdf

[44] https://www.gob.pe/institucion/minam/normas-legales/1955977-096-2021-minam

[45] National Program for Innovation in Fisheries and Aquaculture, *Programa Nacional de Innovación en Pesca y Acuicultura* (PNIPA), Retrieved from: https://pnipa.gob.pe/

[46] National Aquaculture Development Plan, *Plan Nacional de Desarrollo Acuícola* (2010-2021), Retrieved from: https://www.produce.gob.pe/documentos/acuicultura/pnda-resumen-sp.pdf

j. **National Environmental Education Policy (PNEA)**[47]**.** This policy focuses on promoting environmental education based on the notion that nature is inseparable from humans, their societies and cultures. The project highlights adequate environmental and social management as complementary and indispensable for the implementation of all proposed solutions.

k. **National Gender Equality Plan 2012 - 2017**[48]**.** This instrument aims to mainstream the gender approach in public policies of the Peruvian state's three levels of government, guaranteeing equality and the effective protection of human rights for women and men, non-discrimination and the full development of individual and collective potential and capacities.

l. **Law N° 30309**[49]**.** Law No. 30309 aims to promote Scientific Research, Technological Development and Technological Innovation through tax benefits applicable to spending on scientific research, technological development and innovation projects.

m. Implementation Plan of the **National Program "*A comer Pescado*" (Let's Eat Fish)"**[50]**,** which encourages consuming highly nutritious hydrobiological products in Peru and focuses on articulating the supply and demand sides. It is essential to consider that trout is a highly nutritional food; it is an important source of potassium and phosphorus, moderate in sodium, magnesium, iron, and zinc, compared to other fresh fish.

n. **National Strategy for Food and Nutritional Security 2013-2021**[51] **(ENSAN).** According to ENSAN, food and nutritional security refers to all individuals' permanent physical, economic and socio-cultural access to sufficient, safe and nutritious food, so that it can be adequately used to meet their nutritional needs.

4. Describe how the project meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

1.208 The project's Environmental and Social Management Plan, which will be included in the full project proposal, will comply with regulations and policies currently in force in Peru referring to the aquaculture sector and the management of resources and activities included in the project. This plan will establish actions aimed at minimizing all risks and complying with the safeguards of the Adaptation Fund's Environmental and Social Policy, as well as CAF (the Implementing Entity) safeguards. In this regard, the Project Team will include a specialist in Environmental and Social Issues, who will follow up on environmental and social management aspects of the activities implemented. This specialist will work with officials from the Regional Governments' DIREPROS and will receive guidance and orientation from MINAM and CAF's environmental, social and gender specialists. Additional information on the laws and compliance actions can be found in the table in section 1.226, pages 54 to 56. However, these are the main regulations that will be complied with:

1.209 Sustainable production measures established by PRODUCE, such as the use of Good Aquaculture Production Practices (BPPA), strengthening institutions, using local development and management schemes, sanitary certifications, producing safe products, biosafety, vaccination protocols, traceability and application of the precautionary principle to minimize possible environmental impacts and irreversible changes to the ecosystem.

1.210 **National Environmental Policy** formulated by MINAM, the governing body and competent authority in environmental matters, issued by Supreme Decree DS N°012-2009-MINAM. This policy is one of Peru's main management instruments for sustainable development. It considers the Rio Declaration on Environment and Development, the United Nations Millennium Development Goals, and other international treaties and declarations signed by the Peruvian State in environmental matters. Considering the integration of public policies' social, environmental, and economic aspects and the needs of current and future generations, the National Environmental Policy is a mandatory instrument that guides public and private activities.

[47] National Environmental Education Policy, *Política Nacional de Educación Ambiental:* http://siar.minam.gob.pe/puno/sites/default/files/archivos/public/docs/2.-planea-2016-2021vf.pdf

[48] National Gender Equality Plan, Plan Nacional de Igualdad de Género 2012 – 2017, retrieved from: https://siteal.iiep.unesco.org/sites/default/files/sit_accion_files/siteal_peru_0172.pdf

[49] See https://cdn.www.gob.pe/uploads/document/file/1066464/Ley_30309.pdf?v=1596051992

[50] Implementation Plan of the National Program "*A comer Pescado*" (Let's Eat Fish), Retrieved from: http://www.acomerpescado.gob.pe/wp-content/uploads/2016/08/Plan-de-Implementaci%C3%B3n-de-ACP.pdf

[51] *Estrategia Nacional de Seguridad Alimentaria y Nutricional* 2013-2021 (National Strategy for Food and Nutritional Security ENSAN), Retrieved from: https://extranet.who.int/nutrition/gina/sites/default/filesstore/PER%202013%20-%20ENSAN_Estrategia- Nacional-Seguridad-Alime.pdf

1.211 **National Biodiversity Strategy approved by Supreme Decree N°102-2001-PCM**. This is a shared, consensual, strategic vision of national development, which guides future actions aimed at generating economic and social-ecological benefits for present and future generations.

1.212 **Law No. 26839 on the Conservation and Sustainable Use of Biological Diversity**, which regulates the conservation of biological diversity and the sustainable use of its components. In the context of sustainable development, the conservation and sustainable use of biological diversity involves: (a) conserving the diversity of ecosystems, species and genes, as well as maintaining essential ecological processes that species depend on to survive, (b) promoting that the benefits of biological diversity are shared fairly and equitably, (c) encouraging education, information exchange, creation of human resource capacities, scientific research and technology transfer related to biological diversity and the sustainable use of its components, and d) promoting Peru's economic development based on the sustainable use of biological diversity, and encouraging the private sector's participation for these purposes. The project addresses all these aspects.

1.213 National Gender Equality Policy D.S. 008-2019-MIMP and Law No. 28983 on equal opportunities between men and women, which establishes the regulatory, institutional, and public policy framework at the national, regional and local levels, to guarantee women's and men's rights to equality, dignity, free development, welfare and autonomy, preventing discrimination in all spheres of their public and private lives, and aiming for full equality. The project will be aligned with these regulations by giving priority to women and female heads of household to receive benefits and employment in silage plants, as well as giving them a voice and right to vote in consultative workshops, meetings and community assemblies held as part of the project.

5. Describe if there is duplication of project with other funding sources, if any.

1.214 Currently, there are no similar projects focusing on strengthening the resilience of the most vulnerable fish farmers in Huanuco, Junin and Puno in Peru. There aren't other comprehensive resilience programs such as the project described in this Concept Note, which addresses policy instruments, procedures, training, improved opportunities for accessing financing, technologies for innovation and resilience, and strengthening the competitiveness of fish farmers in the market of the trout farming value chain.

1.215 It is worth noting that the project "Adaptation to the Impacts of Climate Change on Peru's Coastal Marine Ecosystem and Fisheries", financed by the Adaptation Fund, implemented by PROFONAMPE and executed by PRODUCE since 2018, addresses a different economic activity, as it deals with artisanal fishing of species such as giant squid, yellowfin tuna and hake, among others, which is completely different from aquaculture.

1.216 It should be emphasized that this project directly benefits the most vulnerable rainbow trout aquaculture producers, such as AMYPE and AREL, which comprise families with limited economic resources that lack access to financing offered by first-tier banks or other funds, such as PNIPA, which requires counterpart funds or the acquisition of credit. This is why we do not consider that similar efforts or initiatives are being duplicated or carried out in the regions of Huanuco, Junin and Puno.

1.217 However, it is worth noting that PNIPA's lines of intervention have included the implementation of various studies and technical assistance initiatives, which have yielded lessons learned that have been considered for the design of this project.

6. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

1.218 Capacity building is a cross-cutting element in all project components. Therefore, the project will support institutional capacity building by structuring governance tools, such as plans and regulations, to improve articulation, coordination, and cooperation among officials from different institutions who work in the aquaculture sector. These public policy instruments will also contribute to the sustainability of different initiatives. The project aims for aquaculture farmers to learn and master the resilient technologies and infrastructures that will be implemented as part of the project, ensuring they acquire technical knowledge to manage and maintain the solutions provided and learn about climate change's impact, vulnerabilities, and risks for aquaculture. Different tools such as demonstration sessions, workshop proceedings, technical guides, manuals and others, will serve to share with the entire aquaculture community information and knowledge on technological solutions, resilient infrastructure, structuring funding requests, managing the information provided by EWS and implementing appropriate responses as part of the contingency plans. Training centers and universities will play critical roles in sharing valuable information with all aquaculture producers and ensuring that lessons learned are properly communicated and disseminated. The project also considers publishing a document systematizing the results and lessons learned to raise awareness among

institutions, funders, fish farmers and society in general regarding the importance of the aquaculture sector for Peru's development, the value of trout as a nutritious food, and especially this initiative's sustainability and potential for replication in other regions.

Additionally, in cooperation with MINAM's and CAF's communications area, audiovisual material will be produced so that it can be shared on social networks and the internet in general and can be presented in universities and training centers.

7. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.

1.219 Based on joint work between MINAM (NDA), PRODUCE, and the Regional Production Directorates (DIREPRO), four consultative workshops were held on July 11, 2022, in Junin; July 13, 2022, in Huanuco; and July 15, 2022, and October 20, 2022, in Puno. Fish farmers, authorities, and officials from DIREPRO, Climate Change Focal Points of the Regional Natural Resources Management Office and the Economic Development Management Office of the Regional Governments of Junin, Huanuco and Puno, and representatives of MINAM and PRODUCE attended these workshops.

The group dynamics in the consultative workshops enabled the collection of more diversified and specific information from fish farmers, considering their proposals, perceptions, and approaches. During the workshops, interventions from both male and female fish farmers were taken into account, and it was an opportunity to identify their strengths and weaknesses and listen to their proposals.

In all workshops, information and training was initially provided on the following issues:

- The importance of NDC climate commitments on adaptation assumed by Peru for the fisheries and aquaculture sector, including its territorial articulation. In this context, ensuring that the project to be submitted to the Adaptation Fund reflects the NDCs aquaculture measures according to the characteristics of each prioritized region.
- The importance of the participation of the beneficiaries or aquaculture farmers in the workshops and designing the initiative to reduce climate change effects on aquaculture activities in the selected areas and strengthen their resilience.
- The project's design was explained, highlighting the climate risks the initiative addresses, its objective, components and activities.
- DIREPRO officials (the fishing and aquaculture competent authorities at the regional level), were consulted for the selection and prioritization of intervention areas for the project's components 2 and 3. Considering the nature of the project, these components will reach fish farmers directly. These consultations were done through a participatory approach and considering regional information and technical criteria based on exposure and vulnerability to climate change, mode of organization (formalization), AMYPE small and medium enterprises, among others.
- A consultative and participatory process was carried out with participating fish farmers, using a matrix and recreational material (slips of paper, markers and cards) to help them reach a consensus on the climate-related problems they face. Workshop facilitators presented the project's components and activities and explained how they could help address these problems. Participants asked questions and commented on each component and activity, providing feedback and validating the project's proposal.
- As part of a feedback process, the roles and gaps between men and women in the aquaculture activity were identified and possible alternative solutions were suggested to strengthen women's participation and improve equality.

1.220 The workshop in Puno on October 20, 2022, offered childcare services for participants' children, encouraging women's assistance.

Figure 21. Childcare during the consultative workshop held in Puno on October 20, 2022.

1.221 Despite the inconveniences, women somehow related to trout farming could participate in the consultative workshops. In the consultative workshop held in Huanuco, 30% of the attendees were women; in the first workshop held in Puno, 31% were women, and in the second workshop, 36% were women. However, in the consultative workshop held in Huanuco, women were absent.

The experience gained in the first consultative processes provided valuable lessons for future consultations, including the need to consider each region's idiosyncrasies and cultural and social aspects. This will help encourage women's participation in the prioritized areas, especially in Huanuco, where women could not attend.

Figure 22. Women participants in the consultative workshop held in Puno on October 20, 2022.

1.222 In the context of the gender approach applied in the various consultations, women expressed the main difficulties they face in the trout farming value chain: lack of time due to their responsibilities at home, since they are strongly involved in care economy activities; low participation, due to the lack of inclusion and prevailing macho ideology; wage discrimination; lack of training for women; and difficulties to access financing. Among these aspects, women highlighted the lack of time due to the different roles they play at home, such as childcare, as they don't have anyone to look after their children while they work, and household work, among others. They also highlighted that macho attitudes still prevail in their regions and women are excluded from social organizations. They noted women's need for training to improve their performance in productive activities.

1.223 One of the interviews with a female fish farmer from the Puno region is worth mentioning. The following is part of Ms. Claudia Mamani's testimony during the consultative workshop held on October 20, 2022.:

- "…People are *always talking about that (climate change), but we do not have the technology, we lack technology as an organization, as specific companies, even if we had our own resources, let's say, because these technologies cost, they are not accessible..."*…"
- "…*Basically, aquaculture is the livelihood that provides daily food, and it is very important. Yes, this is our activity, it's how we make a living*…"
- "…*we will obviously improve a lot if we have the right technology; we will be able to prevent many things...For example, windstorms; technology will help us ensure that we can improve our infrastructure.*…"
- "…*Of course, there are more women interested in aquaculture, and especially those of us who are here, we really work together with our husbands*".
- "…*Climatic change comes as a surprise, it is something that cannot be predicted, we have lost our cages, our cages have collapsed and if we had that, it could somehow be prevented, at least we would not suffer any losses.*…".
- "…*Well, it will be very good if the project becomes a reality, but the project needs follow-up, it's not like they can bring and install the technology and forget about it...*"

Sra. Claudia Mamani, acuicultora entrevistada en uno de los talleres consultivos realizados en Puno

1.224 Below are some pictures of the consultative workshops held in Huanuco, Junin and Puno.

Figure 23. Pictures of the consultative workshop held in the Department of Huanuco.

Figure 24. Pictures of the consultative workshop held in Puno with the Association of Aquaculture Farmers El Faro.

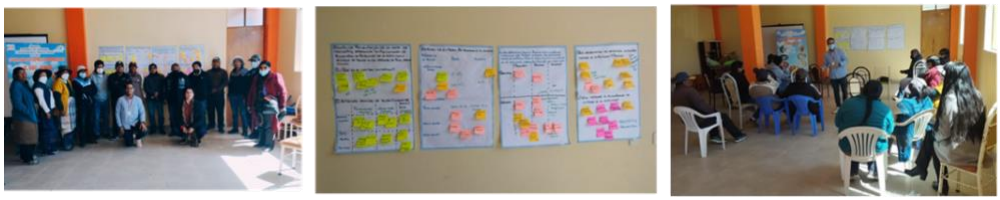


Figure 25. **Pictures** of the consultative workshop held in Ingenio, Junin.

Figure 26. Pictures of the second consultative workshop held in Puno

- **Describe how the sustainability of the project outcomes has been taken into account when designing the project.**

1.225 In the context of the project, the regulations and policy instruments generated or adjusted while focusing on climate change will lay the groundwork for the continuity of good practices, controls and commitments of key stakeholders. Moreover, the project's sustainability will be strengthened by involving multiple stakeholders, such as institutions with influence on the sectoral innovation system promotion policy, actors of the cross-cutting innovation promotion policy, education and research entities, and companies. It is also expected that building the capacities of sector stakeholders on climate change impacts on aquaculture will help them acquire the knowledge and skills to sustain, leverage and replicate the project results. Adequate training and tools to access financial mechanisms and the diversification of aquaculture activities through ecotourism, farming of resilient species, and full utilization of crops will ensure the sustainability of the project's benefits.

1.226 The academic sector will play a critical role in the project. Peruvian universities have conducted research and compiled information to strengthen the project proposal and generate new knowledge and future innovations. Likewise, fish farmers' market competitiveness, the reduction of fry mortality and increased productivity will help ensure the proper maintenance of equipment and new investments. The knowledge and skills acquired will help improve the use of climate information and increase the offer of financing resources by first-tier banks, development banks or climate funds.

- **Provide an overview of the environmental and social impacts and risks identified as being relevant to the project.**

The following table shows a preliminary environmental and social analysis for each Adaptation Fund safeguard. The full project proposal will expand on the risks identified and the actions necessary to mitigate them and will also include a complete Environmental and Social Management Plan to be implemented.

Environmental and social principles checklist	No further assessment is required for compliance	Potential impacts and risks: further assessment and management is required for compliance
Principle 1: Compliance with legislation.	Further assessment required	National legislation does not require limited resource aquaculture (AREL) fish farmers to have an Environmental Management Instrument (IGA) to carry out their aquaculture activities; however, the General Aquaculture Law and its regulation D.L. N°1195 require their activities to be aligned and regulated in the framework of the applicable environmental legislation, mainly in the waste and effluent management sectoral and general regulations. Likewise, Supreme Decree No. 012-2019-PRODUCE, which approves the Environmental Management Regulations for the Fishing and Aquaculture Subsectors, establishes the submission of an Environmental Technical Sheet (FTA), which is complementary to the National Environmental Impact Assessment System (SEIA). However, the format for the preparation of the FTA has not been approved by the environmental authority, so this requirement is not yet enforceable. In the case of micro and small-scale aquaculture enterprises (AMYPE), existing regulations require the preparation of an Environmental Impact Statement (EIS), which must be approved by the regional governments within their jurisdiction and prepared following the National Environmental Impact Assessment System (SEIA), establishing environmental management actions necessary to mitigate and control environmental impacts. In the consultative workshops held in Huanuco, Junin, and Puno, it was not possible to verify the status of the project's environmental and social management aspects regarding the final beneficiaries. A future evaluation of this criterion is required for the full proposal. This principle requires further evaluation, considering that there is no detailed information on the environmental, social, security and gender management aspects of final beneficiaries. It is expected that the implementation of good practices can mitigate risks. They will be defined in the project's "Good environmental and occupational safety practices in Huanuco, Junin and Puno" component. The environmental and social risk management measures include actions to complete the evaluation of the beneficiaries' environmental and social management status, as well as the definition of a plan to close the gaps, if necessary. As indicated, it may be necessary to complement and/or define Environmental Management Plans (EMP) for the beneficiaries, which include measures to prevent, mitigate and control the environmental and social impacts of their activities, within the framework of regulatory compliance.
Principle 2: Access and equity.	**No further assessment is required for compliance**	The project's scope mainly includes limited resource aquaculture (AREL), which comprises subsistence aquaculture farmers and micro and small enterprise aquaculture farmers (AMYPE). In the context of the project, workshops have been held to identify the final beneficiaries engaged in aquaculture activities, as well as vulnerable groups in Huanuco, Junin and Puno. Ensuring access to and equity of the project's benefits has been a constant concern throughout the project's design and implementation stages and during the workshops. The project does not foresee a negative impact on access or equity, so no additional evaluation of this principle is considered necessary.
Principle 3: Marginalized and vulnerable groups	Further assessment required	Vulnerable groups are being identified in participatory workshops based on the following criteria: (i) poverty level; (ii) sensitivity level according to IPCC; (iii) harvest level; (iv) ecological sensitivity, according to IMARPE criteria; and (v) socioeconomic adaptive capacity. This principle requires further evaluation. The environmental and social risk management measures include actions to prevent and mitigate negative impacts on marginalized and vulnerable groups, such as children, women and girls, the elderly, and indigenous peoples, among others. The project will help improve people's quality of life under the project components. Therefore, it is expected to impact vulnerable and marginalized groups positively.
Principle 4: Human rights	No impact on human rights is anticipated	The Universal Declaration of Human Rights proclaimed and adopted by the United Nations General Assembly on December 10, 1948, was approved in Peru through Legislative Resolution No. 13282, dated December 9, 1959. The design and formulation of the project and the workshops are in line with the protection of human rights under human rights law. Human rights will be further protected through the implementation of project activities. The project does not foresee a negative impact on human rights, so no additional assessment of this principle is necessary.

Environmental and social principles checklist	No further assessment is required for compliance	Potential impacts and risks: further assessment and management is required for compliance
Principle 5: Gender equality and women's empowerment	Further assessment required	Peru has a National Gender Equality Policy D.S. 008-2019-MIMP, as well as Law No. 28983 on equal opportunities between men and women, which establishes the regulatory, institutional, and public policy framework at the national, regional and local levels, to guarantee women and men their rights to equality, dignity, free development, well-being and autonomy, preventing discrimination in all public and private spheres of their lives, tending to full equality. Peru has also signed the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), a treaty of the Universal System of Human Rights signed and ratified without reservations by the Peruvian State and is, therefore, in force at the national level. The project considers gender equity under the regulations and agreements signed and ratified by Peru and the principles of the Adaptation Fund. Furthermore, the project addresses and promotes the participation of women in aquaculture, incorporating a gender approach in the various technical and regulatory climate change instruments and technologies to be developed. This principle requires further evaluation, considering that there is still no detailed gender-related information on all the final beneficiaries.
Principle 6: Fundamental labor rights.	Further assessment required	Peru has been a member of the ILO since 1919; it has ratified 76 conventions (67 in force) on fundamental principles and rights at work. The project's design and components include establishing good environmental and occupational safety practices to ensure compliance with ILO labor standards and the country's labor and occupational safety regulations. This principle requires further evaluation, considering that there is no detailed information on occupational safety aspects of final beneficiaries. It is expected that the implementation of good practices can mitigate risks. They will be defined in the project's "Good environmental and occupational safety practices in Huanuco, Junin and Puno" component.
Principle 7: Indigenous peoples.	No impact on indigenous peoples is foreseen	No indigenous peoples have been identified in the beneficiaries' territories, nor have beneficiaries been identified as belonging to indigenous peoples. No further assessment of this principle is required.
Principle 8: Involuntary resettlement.	No involuntary resettlement is foreseen.	No activities requiring resettlement have been proposed. No additional assessment of this principle is required.
Principle 9: Protection of natural habitats.	Further assessment required	The Lake Titicaca RAMSAR site[52] was created on January 20, 1997, in the department of Puno. Within the classification of wetlands proposed by the RAMSAR Convention, Lake Titicaca is considered a complex of inland wetlands of types 4 (Riparian plains), 5 (Permanent freshwater lake) and 10 (Herbaceous marshes: shrubby). It is estimated that, to date, a little more than 14,000 hectares of Lake Titicaca's aquatic surface are authorized and used for aquaculture. Trout farming in floating cage systems is intensive and is carried out in certain areas of Lake Titicaca. The project beneficiaries in the Department of Puno are located in Lake Titicaca, in RAMSAR site areas, and are authorized by the Regional Production Directorate and the Ministry of Production in the Puno Region. The Titicaca National Reserve is in Lake Titicaca; in this area, no aquaculture activities are carried out and there are no final beneficiaries. The beneficiaries located in the departments of Junin and Huanuco are not in Natural Protected Areas (NPAs) or in legally protected sensitive habitats. This principle requires additional assessment, mainly of the critical habitats and impacts associated with the activity, as well as the planned management measures, considering that detailed information on the environmental management aspects of all final beneficiaries is not yet available. It is expected that the risks can be mitigated through the implementation of best practices, which will be defined in the component of the project called "Good environmental and occupational safety practices in Huanuco, Junin and Puno," which will cover the entire aquaculture production process. Environmental and social risk management measures include actions to protect natural habitats.
Principle 10: Biodiversity Conservation	Further assessment required	Rainbow trout introduction into Peru was made official in 1940. This species is now considered a naturalized species in Peru, as autonomous populations have been established in habitats where they were previously considered exotic (Cossíos 2010). Rainbow trout is a priority species for biosecurity in Peru because when this species is introduced into a natural environment without any analysis or control, it can cause a great impact

[52] RAMSAR site: The Convention on Wetlands is an intergovernmental treaty adopted on 2 February 1971 in the Iranian town of Ramsar, located on the shores of the Caspian Sea. Therefore, although today the name commonly used to designate the Convention is "The Convention on Wetlands (Ramsar, Iran, 1971)", it has become commonly known as "the Ramsar Convention"

Environmental and social principles checklist	No further assessment is required for compliance	Potential impacts and risks: further assessment and management is required for compliance
		on native biodiversity[53]. The sector has standards and manuals for sustainable aquaculture management. Peru has also signed and ratified the Convention on Biological Diversity (CBD). The potential impacts of beneficiaries' activities cannot be fully explored at this stage; therefore, the risks' extent cannot be accurately determined. This principle requires further assessment, including an analysis of biodiversity risks and identifying associated measures to avoid impact. It is expected that the risks can be mitigated through the implementation of best practices, which will be defined in the component of the project called "Good environmental and occupational safety practices in Huanuco, Junin and Puno," which will cover the entire aquaculture production process.
Principle 11: Climate change	No further assessment is required for compliance	The project focuses on reducing the population's vulnerability to the effects of climate change. In this sense, it considers climate change adaptation in all stages and the implementation of the project represents an adaptation measure for the sector. The activities foreseen in the components for small and medium-scale aquaculture activity beneficiaries have the potential to increase greenhouse gas emissions, but not significantly.
Principle 12: Pollution Prevention and Resource Efficiency	Further assessment required	We have not been able to verify the status of final beneficiaries' environmental and social management practices, nor the environmental and social strategy defined for the implementation of activities. This principle requires further evaluation, considering there is still no detailed information on the current situation of all final beneficiaries in terms of environmental management. It is expected that the risks can be mitigated through the implementation of best practices, which will be defined in the component of the project called "Good environmental and occupational safety practices in Huanuco, Junin and Puno," which will cover the entire aquaculture production process. The project must establish guidelines for the prevention and minimization of environmental impacts and the efficient use of resources, such as minimizing waste generation, energy efficiency (equipment or other), and emissions.
Principle 13: Public health	Further assessment required	The project's Component 3 aims to strengthen the aquaculture sector's value chain. This component foresees the participation of the National Fisheries Health Agency (*Organismo Nacional de Sanidad Pesquera*, SANIPES), which is the competent authority responsible for monitoring and controlling hydrobiological resources' diseases from aquaculture or the natural (wild) environment to ensure their sanitary condition. Likewise, a Sanitary Protocol will be defined for COVID-19 prevention and control. This principle will require further evaluation, considering that there is still no detailed information on the current situation of all final beneficiaries in terms of public health.
Principle 14: Physical and cultural heritage	No further assessment is required for compliance	No physical or cultural heritage has been identified in the beneficiaries' territories. No additional evaluation of this principle is required.
Principle 15: Land and soil conservation	Further assessment required	We have not been able to verify the status of final beneficiaries' environmental and social management practices, nor the environmental and social strategy defined for the implementation of activities. The project's beneficiaries are in specific sites where aquaculture activities are currently implemented, so no significant soil impacts are expected. This principle requires further evaluation, considering that there is no detailed information on land and soil conservation aspects of final beneficiaries. The project should establish management measures in the Environmental Management Plan to prevent and minimize environmental impacts and soil conservation at the site.

[53] Baseline of rainbow trout for biosecurity purposes in Peru, 2021.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project implementation.

1.227 The project was developed through a consultation process with close collaboration between MINAM, PRODUCE and CAF.

1.228 PRODUCE will act as the Technical Executing Entity, based on the extensive technical capacity and experience of its officials from the General Directorate of Aquaculture (*Dirección General de Acuicultura*, DGA) and the Regional Production Directorates (*Direcciones Regionales de la Producción*, DIREPROS). The latter have shared competencies with PRODUCE in the areas of micro and small-scale aquaculture (AMYPE) and limited resource aquaculture (AREL), although they are part of the Regional Governments (Huanuco, Junin and Puno).

1.229 The Regional Governments (GORE) will be actively involved in the project, given that their powers are to oversee, promote and strengthen governance. Furthermore, certain mechanisms are established under which the GORE will be involved in coordination bodies such as working groups and steering councils and will provide support for the implementation of actions.

1.230 In its role as the Implementing Entity, CAF will carry out the required supervision, monitoring and coordination to ensure the successful execution of the project and compliance with its technical, administrative, accounting and fiduciary regulations. CAF will guarantee the application of internationally accepted fiduciary standards, which translates into total transparency in managing resources received. CAF will also apply its contracting standards for the evaluation and selection of an entity that certifies it has the fiduciary capacity to perform the role of Administrative Executing Agency. In this process, MINAM and PRODUCE representatives will be invited to the Committee for the Evaluation and Selection of an Administrative Executing Entity.

1.231 Binding agreements will be signed between CAF, MINAM, PRODUCE, and the Administrative Executing Agency to define roles and responsibilities and ensure compliance with the respective standards, the environmental and social management plan, the development of best practices, audits, inventory control and biosafety plans, among other parameters.

1.232 Specifically, besides PRODUCE'S DGA, FONDEPES, the Peruvian Marine Institute (Instituto del Mar del Perú) and the DIREPROs of the Regional Governments of Huanuco, Junin and Puno will be involved in Component 1, as they are key actors in the generation and application of regulations to strengthen the technical and operational management of aquaculture.

1.233 Component 2 will involve the participation of PRODUCE'S DGA, DIREPRO, the Technological Institute of Production, through its Centers for Productive Technological Innovation (CITE), and the PNIPA, as they are key actors that promote the creation of an innovation agenda and the formation of a network of actors linked to trout farming, research, production, marketing and value chain management in order to implement interventions that support adaptation to climate change in aquaculture activities.

1.234 Component 3 will include the participation of the DGA of PRODUCE, FONDEPES, SANIPES, ITP, PNIPA, and the National Program Let's Eat Fish (*Programa Nacional A Comer Pescado*, PNACP), as they are key actors in promoting the adoption of technologies for production processes, strengthening value chains and the consumption of fishery and/or aquaculture resources.

1.235 An Advisory Steering Committee will be formed to provide advice, offer guidance and supervision for the adequate development of the Project and the fulfillment of its objectives. Its recommendations will be addressed to the Technical Executing Agency - PRODUCE. The functions of the Advisory Steering Committee address recommendations on technical assistance to the Project Team. It will also provide support to control risks and ensure quality of the Project and the report submitted to the implementing entity. The Advisory Steering Committee will consist of:

- Representatives of MINAM, Peruvian Focal Point to the Adaptation Fund and Designated National Authority.
- Representatives of PRODUCE, Technical Executing Agency.
- Directors of the DIREPROS of the Regional Governments of Huanuco, Junin and Puno.
- Representatives of the Administrative Executing Agency (to be defined).
- Representatives of CAF, the Implementing Entity.
- Representatives of the Regional Environmental Authorities.

1.236 The project includes the creation of a Project Team that will report to the Advisory Steering Committee, the Implementing Entity and the Executing Entities. DIREPROS officials from Huanuco, Junin and Puno,

entities that share functions with PRODUCE and are part of the Regional Governments will actively participate in the implementation of each project component. This will help ensure the project's sustainability. Technically, each component will be coordinated under the leadership of DIREPROS officials with assistance from a Technical Support Specialist hired with project resources.

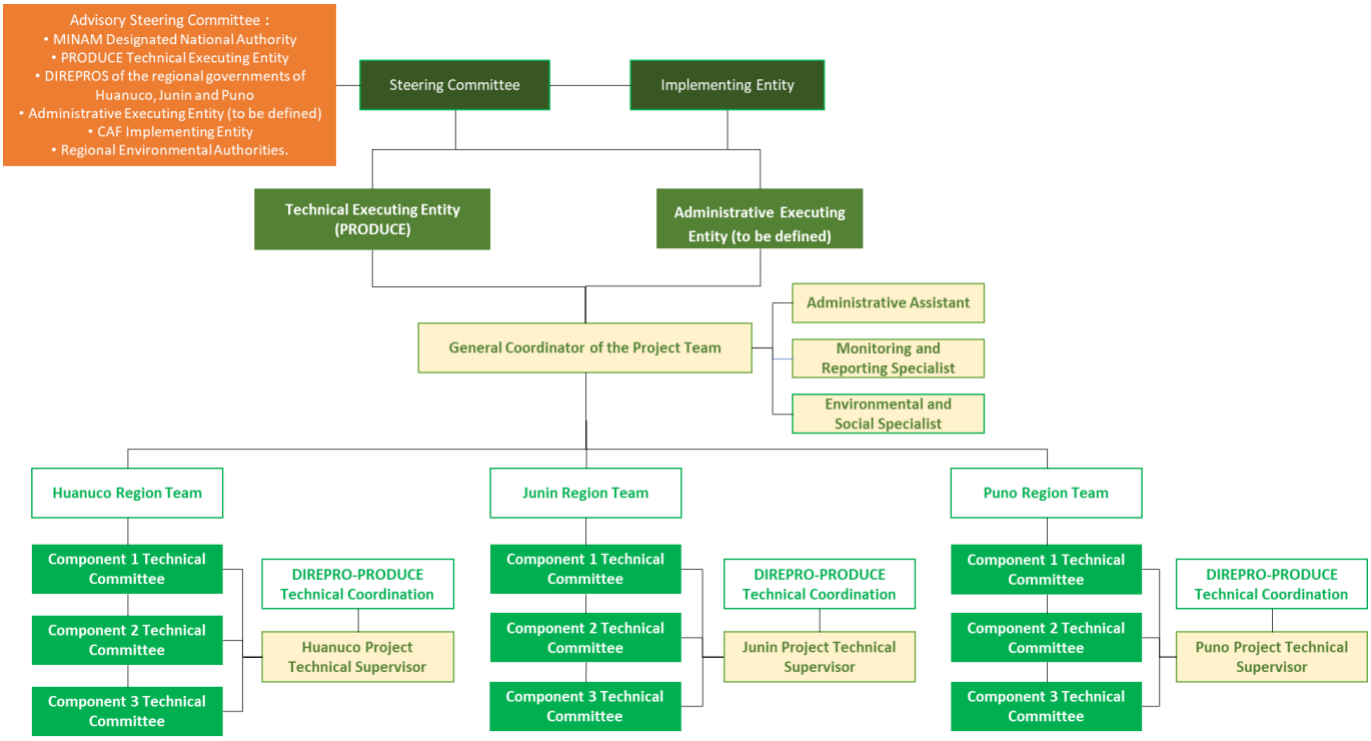
1.237 The Project Team will have a General Coordinator in charge of supervising the management and progress of the three project components and the inter-institutional relationship with other key stakeholders. The General Coordinator will review and submit reports required by CAF, PRODUCE, the Administrative Executing Agency and the Advisory Steering Committee.

1.238 The General Coordinator will have a group of supporting staff consisting of one Administrative Assistant, one Environmental and Social Specialist and one Monitoring and Reporting Specialist. An Administrative Assistant will be responsible for managing administrative issues together with the CAF and Administrative Executing Agency team. He/she will also be responsible for collecting and organizing invoices, quotations, beneficiary minutes and their documents, among others. The support of an Administrative Assistant will be essential for ensuring the project's transparency and proper fiduciary management.

An Environmental and Social Specialist will be responsible for field supervision and developing and monitoring adequate environmental and social management issues. He/she will also be in charge of issuing warnings and recommendations for due compliance with the environmental and social management plan and CAF's and the Adaptation Fund's environmental and social policies. An Environmental Specialist and a Gender Specialist from CAF will help evaluate the work of this project specialist.

A Monitoring and Reporting Specialist will be responsible for supporting the General Coordinator in preparing monitoring reports required by CAF and the Adaptation Fund, ensuring full alignment with accounting and management work performed by the Technical Executing Agency and the Administrative Executing Agency. He/she will work closely with the Responsible Executive and CAF's Third-Party Resources Directorate.

1.239 The following chart shows the preliminary structure of the Project Team. The members of the project that will be hired with the resources provided by the Adaptation Fund are highlighted in yellow:



2 Describe the measures for financial and project risk management.

1.240 There are financial, operational, technical and political risks that may affect the success of the project. The risks and mitigation measures for the project are described below.

Type of risk	Risk	Risk mitigation measures
Financial	Fish farmers limited budgetary and administrative capacity.	- Enhance management capacity and train producers in sustainable aquaculture project management programs and practices, as well as in technologies that support cost-efficient investments. - Encourage fish farmers to engage in circular economy activities which reduce wastage and enhance profits. - Provide Project Beneficiaries with ongoing technical assistance on matters relating to finance and management. - The program will assist producers in developing a sustainable business plan and assist them over the life of the project to identify strategies and instrument to improve them financial situation. - Encourage where possible the development of producer associations in clusters, cooperatives, or other type of association to assist them in sharing the financial risk associated with the incorporation of innovative practices and technology into their productive activity. - Governments at the central and local levels will review administrative and legal requirements to reduce administrative requirements while maintaining appropriate oversight.
	Green technologies' initial costs are generally higher than for traditional technologies.	- A platform will be provided for Aquaculture producers to access information regarding available competitive funds that offer reduced rates and/or technical cooperation resources. - TA and support will be provided, to ensure that aquaculture producers are assisted in applying for those competitive funds.
Operational	Delays in the implementation of project activities.	- A project implementation plan, a procurement plan and a disbursement plan will be prepared and regularly updated to ensure maximum efficiency in the implementation of project activities. - An operation manual detailing implementation modalities, expectations and standards will be developed during project preparation and distributed to all stakeholders. - Disbursement will be staggered to consider the learning curve associated with the implementation of a new project. Accordingly, year project disbursement will be backloaded - A project launch workshop will be organized to familiarize all relevant stakeholders with operational modalities for the project. Additionally, workshop with groups of beneficiaries will be carried out to ensure that their understanding of the project, its objective and instruments is clear, and that their concerns are addressed. - Service standards will be established to ensure that there are no delays associated with the review and the approval of project-funded products. - Specific terms of reference will be prepared for all project activities to be implemented by the project during preparation. - Preparation for procurement process will be initiated as soon as legally possible to ensure that time-lags associated with procurement are limited. - During project preparation, staff will be trained and capacitated to ensure that the management of the activities under their preview are executed according to plan. Operational training refreshers will be provided yearly for the life of the project.

Type of risk	Risk	Risk mitigation measures
Technical	Resistance to change and use new infrastructures, tools and technologies.	- The project will include project outreach to academia and technological to increase the quality and availability of aquaculture related curriculum. - One of the project components focuses on training fish farmers and creating training centers.
Political	High Turnover caused by government changes affecting project implementation.	- To ensure policy oversight a project steering committee will be created which includes policy-level representatives of all concerned public agencies. Its role will be to provide policy leadership. - The project will focus on developing relevant mid-level managers and technical specialists understanding of the project, its components and its implementation strategy. - To limit the impact of potential turnover, preparation for procurement activities and development of instruments required to facilitate the implementation of project activity will be completed during project preparation. - A project management team will be created and will maintain operational oversight of the project
	Corruption	- The implementing entity will make sure that project objectives are met and will also ensure effective financial management due diligence. - As part of the management support provided to beneficiary the project will assist in carrying out an anti-corruption compliance audit, highlighting potential risks that the AMYPE or AREL could face in carrying out their day-to-day activities. - Ongoing support will also be provided to ensure that project beneficiaries are aware of all relevant regulations which could enhance systemic and individual corruption risks. - Anti-corruption will be one of the areas of sector specific academic curriculum which will be strengthened so that incoming labor force is aware of potential risks confronted by AMYPE and AREL in the sector.
Governance	Weak governance systems could affect the project.	- The capacity building activities aimed at public servants and other public sector actors. - Project, whenever possible will work with existing platform, among them Clusters, cooperatives with and other types of associations will well established governance systems to enhance governance capacity within the sector.

2 **Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.**

Adaptation Fund Policy	Risk	Risk Management Measure	Means of Verification	Date/ compliance milestone
Principle 1: Compliance with legislation	Risk of lacking sufficient environmental and social management measures.	1. Develop and/or strengthen Environmental and Social Management Plans (ESMP) for beneficiaries. These ESMPs will integrate the country's regulations and the Adaptation Fund Policies.	1.Beneficiaries'PGAS	1.Prior to beginning activities
		2. Implement the measures established in the ESMP.	2.Evidence of ESMP implementation	3.Environmental and social monitoring report
Principle 3: Marginalized and vulnerable groups	Risk of establishing insufficient guidelines for the identification of vulnerable groups.	1. Develop vulnerability criteria for the identification of vulnerable groups in Huanuco, Junin and Puno.	1. Vulnerability criteria report and identification of vulnerable groups	1.Prior to beginning activities
Principle 5: Gender equality and women's empowerment	Risk of establishing insufficient guidelines for gender equality and women's empowerment.	1. Develop a Plan to encourage women's participation in decision making spaces in relation to project planning, and the design and implementation of programs and plans.	1.Plan to encourage the participation of women in job opportunities and decision-making spaces.	1.Concept Note and Full Proposal

Adaptation Fund Policy	Risk	Risk Management Measure	Means of Verification	Date/ compliance milestone
Principle 6: Fundamental labor rights	Risk of having insufficient measures for occupational safety and labor issues.	1. Develop an Occupational Health and Safety Plan, including hazard identification and risk assessment.	1. Occupational Health and Safety Plan	1. Prior to beginning activities
Principle 9: Protection of natural habitats	Risk of not having specific management measures for the protection of natural habitats.	1. Develop a Biodiversity Management Plan (BMP), including an analysis of critical habitats, and conservation measures.	1. Biodiversity Management Plan (BMP)	1. Concept Note and Full Proposal
Principle 10: Biodiversity Conservation	Risk of not having sufficient management measures for biodiversity conservation.	1. Develop a biosecurity plan for aquaculture crops, identifying specific controls.	1. Biosafety plan	1. Concept Note and Full Proposal
Principle 12: Pollution Prevention and Resource Efficiency	Risk of not having sufficient pollution management and resource efficiency measures.	1. Develop a Resource Efficiency Plan that includes measures to mitigate GHG emissions from fossil fuels.	1. Resource Efficiency Plan	1. Concept Note and Full Proposal
Principle 13: Public health	Risk of not having sufficient public health management measures.	1. Develop a Community Health and Safety Management Plan	1. Community health and safety management plan	1. Prior to beginning activities
Principle 15: Land and soil conservation	Risk of not having sufficient soil conservation measures	1. Develop a Soil Conservation Plan in beneficiaries' influence areas.	1. Soil conservation plan	1. Prior to beginning activities
Other aspects:		1. Define the project's environmental and social team, describing all environmental, social, and occupational health and safety responsibilities to be covered during the Project.	1. Organizational chart and definition of the project's environmental, social, and occupational health and safety team	1. Prior to beginning activities
		1. Develop a Citizen Participation Program (PPC), including at least: (i) participatory mechanisms; (ii) mechanisms to disseminate consultations, complaints, claims and social conflicts; (iii) define the schedule and frequency of the proposed activities; (iv) specify the timetable and frequency of the proposed activities.	1. Citizen Participation Plan (PPC)	1. Prior to beginning activities

3 Demonstrate how the project aligns with the Results Framework of the Adaptation Fund

Project Objective and Outcomes[1]	Outcome Indicators	Fund Output	Fund Output Indicator	Grant Amount
Project Objective: Reducing aquaculture's vulnerability to climate change and climate variability, as this is the main livelihood of communities in the regions of Huanuco, Junin and Puno, Peru, by implementing innovation mechanisms and technologies, strengthening capacities and the governance system, as well as increasing market competitiveness				
Component 1: Governance, knowledge management and access to finance for sustainable and climate change resilient aquaculture are strengthened.				
Outcome 1.1. The aquaculture sector's institutional capacities and governance instruments are strengthened in the context of climate change	- 150 Public officials and academic representatives are trained in climate change. - 5 instruments and/or regulations include governance in the context of climate change - 3,744 Rainbow trout farmers (AMYPE and AREL) and their families benefit from strengthened institutions. - 6,688 Aquaculture farmers of other species and their families benefit from strengthened institutions.			**US$ 720,000**
		Output 1.1.1 Programs to strengthen PRODUCE's	Three (3) resilience and	US$ 45,000

Project Objective and Outcomes[1]	Outcome Indicators	Fund Output	Fund Output Indicator	Grant Amount
		Regional Directorates staff.	climate change strengthening programs designed and implemented.	
		Output 1.1.2 Policy instruments are strengthened and/or developed to improve governance in the context of climate change.	Five (5) policy instruments developed or strengthened with risk management and climate change issues.	US$ 120,000
		Output 1.1.3 Climate Change Resilient Aquaculture Training Centers are established.	Three (3) Resilient Aquaculture Training Centers.	US$ 540,000
		Output 1.1.4 Collaboration agreements with universities are developed.	At least two (2) collaboration agreements signed with universities.	
Component 2: Innovation and technology transfer mechanisms are improved and/or implemented to promote resilient aquaculture activity in Huanuco, Junin and Puno, Peru.				
Outcome 2.1. The aquaculture community's response capacity to extreme climate events is improved.	• 3,744 Rainbow trout farmers (AMYPE and AREL) and their families have stronger capacities to respond to climate change events. • 6,688 Aquaculture farmers working with other species and their families are better able to respond to climate change events. • Rainbow trout fry mortality is reduced by 20% (preliminary). • Improved production yield in the rainbow trout fattening stage. • Productivity growth leads to an increase in vulnerable fish farmers' incomes.			**US$ 815,000**
		Output 2.1.1 Design and implementation of Early Warning Systems (EWS) for extreme events in the aquaculture sector. One for each of the prioritized regions of Huanuco, Junin and Puno.	Three (3) EWS designed and implemented.	US$ 550,000
		Output 2.1.2. Contingency Plans are developed for extreme climate change events. One for each region.	Three (3) Contingency Plans developed.	US$ 225,000
		Output 2.1.3. An Integrated Statistical Information System is developed.	One (1) Integrated Statistical Information System.	US$ 40,000
Outcome 2.2. Climate change adaptation infrastructure and technologies enable the sustainable use of hydrobiological resources for aquaculture.	• Rainbow trout farmers (AMYPE and AREL) and their families benefit from climate change resilient infrastructures, which serve as a model and pilot for the rest of the farmers in Huanuco, Junin and Puno. • The mortality of rainbow trout fry is reduced by 20% (preliminary). • Improved production yield in the rainbow trout fattening stage. • Productivity growth leads to an increase in vulnerable fish farmers' incomes.			**US$ 2,073,580**

Project Objective and Outcomes[1]	Outcome Indicators	Fund Output	Fund Output Indicator	Grant Amount
		Output 2.2.1 Resilient infrastructure in areas most vulnerable to climate change and adoption of technologies to adapt production systems to climate change.	-77 Water recirculation systems for ponds. US$ 924,000. - 77 Probiotics US$ 231,000 - 20 Aerators. US$ 60,000 10 BIOFLOC SYSTEMS. - 10 Biofloc systems. US$ 65,000 10 BIOFLOC SYSTEMS. - 76 Oxygenators. US$ 342,000. - 42 Heavy duty climate change resistant cages US$ 184,500 - 1 Offshore cage. US$ 5,000 - 3 water harvesting and reforestation projects. US$ 175,500. - Technologies and tools for proper environmental management US$ 86,580.	US$ 2,073,580
Component 3: Strengthening the value and production chains of resilient aquaculture activities will help diversify aquaculture producers' livelihoods and improve their food security.				
Outcome 3.1. The aquaculture sector's value chains are strengthened, and climate-related losses are reduced.	• Vulnerable rainbow trout farmers and their families become more competitive in the market. • Vulnerable rainbow trout farmers increase their income. • Women participate in the trout value chain.			**US$ 855,000**
		Output 3.1.1 Trout farming production chain facilities are improved.	• Three (3) primary processing plants with silage area are built.	US$ 675,000
		Output 3.1.2 Marketing strategies are in place for aquaculture products in each primary processing stage.	• Three (3) marketing strategies developed and implemented.	US$ 60,000
Outcome 3.2 Aquaculture producers diversify their economic activity.	• Rainbow trout farmers (AMYPE and AREL) in Huanuco, Junin and Puno have Business Plans to carry out activities complementary to rainbow trout that can help increase their income. • Vulnerable trout farmers increase their income. • Women participate in the trout value chain.	**Output 3.2.1**. Business plans are in place for aquaculture farmers in Huanuco, Junin and Puno	• At least two (2) Business Plans developed for each region.	US$ 120,000

[1] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology, but the overall principle should still apply

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[2]

Provide the name and position of the government official and indicate date of endorsement. The endorsement letter(s) should be attached as an annex to the project proposal. Please attach the endorsement letter(s) with this template.

Milagros Sandoval Díaz Head of the General Directorate of Climate Change and Desertification Ministry of the Environment Designated Authority	Date*:* January 09th 2023

B. Implementing Entity certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project contact person's name, telephone number and email address

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (*Framework Law on Climate Change; The National Climate Change Strategy; National Adaptation Plan; Updated report on Nationally Determined Contributions for 2021-2030, and others*) and subject to the approval by the Adaptation Fund Board, commit to implementing the project in compliance with the Environmental and Social Policy and the Gender Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project.

Martha Patricia Castillo Principal Executive Fiduciary Aspects Climate Action and Positive Biodiversity Division	
Date: January 09th 2023	Tel. and email: +57 300 2672853 mcastillo@caf.com
Project Contact Person: María Carolina Torres Executive of Climate Action and Positive Biodiversity Division	
Tel. and email: +521 55 3514 5690 mctorres@caf.com	

Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

ANNEX 5: ENDORSEMENT LETTER

PERÚ | Ministerio del Ambiente | Viceministerio de Desarrollo Estratégico de los Recursos Naturales | MINAM | Dirección General de Cambio Climático y Desertificación

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Motivo: Soy el autor del documento
Fecha: 09/01/2023 11:08:50-0500

"Decenio de la Igualdad de Oportunidades para mujeres y hombres"

Lima, 09 de enero de 2023

LETTER N° 00005-2023-MINAM/VMDERN/DGCCD

Messrs.
The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Washington
United States
Email: Secretariat@adaptation-fund.org
Fax: 202 522 3240/5

Subject : Endorsement of the project "Implementing protection technologies to foster the resilience of aquaculture in the regions of Huanuco, Junin, and Puno to strengthen food security in the context of extreme events associated with climate change".

The Ministry of the Environment of Peru is the governing body of the National Climate Change Strategy of Peru and is the ministry in charge of informing the United Nations Framework Convention on Climate Change on the commitments of Nationally Determined Contributions (NDC). Within this framework, the concept note "Implementing protection technologies to foster the resilience of aquaculture in the regions of Huanuco, Junin, and Puno to strengthen food security in the context of extreme events associated with climate change" has been evaluated, to be presented to the Adaptation Fund. This proposal will contribute to reduce aquaculture's vulnerability to climate change and climate variability in three regions of Peru, by implementing innovation mechanisms and technologies, strengthening their capacities and governance system, as well as increasing their market competitiveness.

In this vein, I am pleased to endorse the concept note mentioned above with support from the Adaptation Fund. If approved, we will ensure that the project is aligned with our climate change adaptation targets, and that is duly coordinated between the Ministry of Environment and CAF.

We appreciate your attention very much, and thank you for your kind consideration.

Sincerely yours,

Milagros Sandoval Díaz
Head of the General Directorate of Climate Change and Desertification
Ministry of the Environment
Designated Authority

File number: 2022073271

This is an authentic printable copy of a document filed in the Ministry of the Environment, applying the provisions of Art. 25 of S.D. 070-2013-PCM and the Third Final Complementary Provision of the S.D. 026-2016-PCM. Its authenticity and integrity can be verified at the website: https://ecodoc.minam.gob.pe/verifica/view with the following password: **1baba5**

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